

NOISES IN
THE HEAD AND EARS

MACNAUGHTON JONES

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Subjective Noises in the Head and Ears:

THEIR

Etiology, Diagnosis and Treatment.

BY

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FORMERLY

EXAMINER IN OBSTETRICS AND DISEASES OF INFANT LIFE
IN THE ROYAL UNIVERSITY.

UNIVERSITY PROFESSOR OF MIDWIFERY AND DISEASES OF WOMEN AND CHILDREN IN
THE QUEEN'S UNIVERSITY, ETC.



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TO
DR. ADAM POLITZER,
PROFESSOR OF OTOLOGY IN THE UNIVERSITY OF VIENNA,
IN RECOGNITION OF
HIS UNRIVALLED ACHIEVEMENTS IN OTOLOGICAL SCIENCE,
THIS WORK IS
GRATEFULLY AND BY PERMISSION DEDICATED
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PREFACE.

THE origin of this work was a paper on the Etiology of Tinnitus, read at the Annual Meeting of the British Medical Association at Birmingham in August, 1890. At that meeting I undertook to open the discussion on the subject in the otological section.

It was there unanimously resolved that the paper, which was unavoidably lengthy, should be republished *in extenso* in the Journal of the Association for circulation amongst those members attending the section. This led to my having the paper reprinted from the Journal. So many medical friends and others wrote regretting that I had not referred to the diagnosis or treatment of tinnitus aurium, that I determined to complete that paper by adding the chapters on diagnosis, prognosis and treatment.

I have, therefore, reproduced in Chapter I. the remarks made at the Birmingham meeting.* I do not pretend that this is by any means a complete analysis of the causes of this most troublesome symptom. It is, however, the first attempt at any systematic differentiation of causes, that I am aware of, based on anatomical, physiological and pathological grounds. I have to apologise for its incompleteness. It may, however, assist the practitioner in classifying the individual case of tinnitus that comes before him, which is the first step to its prognosis and treatment. I am aware how unsatisfactory is our special knowledge of the entire subject of tinnitus and how disappointing are the results of treatment. This latter, we must confess, is often empirical, from

* Chapters III. and IV. appeared as an original article in the *Lancet* of May 16, 1891.

our ignorance of the processes operating in the production of some of its forms. I hope, however, that the perusal of this little work will be of some assistance to those who have to deal with this most obstinate yet distressing condition. It is with diffidence that I place it before the profession, but it truthfully gives the results of over twenty years' experience of that affection of which it treats.

The concluding chapter on *Further remarks on Electrical Treatment of Tinnitus*, has been written by Dr. James Cagney, his special study of this subject rendering him peculiarly fitted for such a task. In the larger aural works by Prof. Adam Politzer (translated by the late Dr. J. Patterson Cassells), Dr. Josef Gruber (translated by Dr. Edward Law and Mr. Coleman Jewell), Dr. Charles Burnett, and others, the reader will find the most complete information on all matters relating to otological science. The *brochure* by Dr. Woakes, on *Deafness, Giddiness and Noises in the Head*, will also repay perusal.

I can strongly recommend to the practitioner the works of Drs. Bosworth and Sajous (New York). The author's *Practitioners' Handbook of Diseases of the Ear and Naso-Pharynx* (4th edition), is at present in the press. I have to thank Mr. W. H. R. Stewart for his correction of the proof sheets. I have also to express my obligation to Professor Politzer for his kind perusal of the text before going to press, and my gratification at his verdict that he "did not consider it necessary to add any notes to the work."

H. MACNAUGHTON JONES.

141, HARLEY STREET, CAVENDISH SQUARE,
June, 1891.

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SUBJECTIVE
NOISES IN THE HEAD AND EARS.

(*TINNITUS AURIUM.*)

CHAPTER I.

CAUSATION.

A DIFFERENTIATION based on a critical analysis of cases must be the first step towards an enlightened treatment of tinnitus. It is not because we have to admit that there is a certain vagueness in our present knowledge of the physiological processes in operation in the production of tinnitus that we should hesitate to avail ourselves of what knowledge we possess, and which is derived from the study of normal and abnormal physiological facts viewed side by side with clinical and pathological phenomena. Indeed, it is our duty as otologists, in this as in other matters of general medical and surgical interest arising out of our speciality, to lead the van in the spread of otological knowledge generally, and thus gradually to arrest that deplorable ignorance in aural matters which unfortunately exists.

We will first consider the causation of tinnitus and a few of the anatomical and physiological problems connected with its origin, with a view to arriving at a more scientifically concise and accurate differentiation of the causes of tinnitus.

Perchance, as a personal sufferer in the past, from two

distinct varieties of tinnitus, I have taken special interest in this most troublesome symptom of affections of the ear and other organs.

In the winter of 1878 and the spring and summer of 1879, I had excessively hard work. The meeting of the British Medical Association occurred in the latter year in Ireland (at which, by the way, at my instigation an Otological Section was first instituted) and the secretarial work of that meeting placed great additional labour on my shoulders. Up to the end of 1879 I suffered from a vascular pulsating tinnitus in my left ear, which accompanied the cardiac systole; the noise was exactly like an aortic regurgitant murmur; it was present only on retiring to rest and on awaking in the morning, often prevented sleep, and was partially relieved by deep and firm pressure on the mastoid and behind the condyle of the jaw.

In mentioning this fact to Dr. Dundas Grant, he has reminded me of his observation, how such tinnitus was interrupted by pressure in the suboccipital triangle on the vertebral artery, this pressure affecting the circulation through the auditory artery. He suggests this as a diagnostic test of a labyrinthine tinnitus. In my case I believe the pressure was exerted on the external carotid, posterior auricular and stylo-mastoid vessels.

During this time I had a slight functional cardiac irregularity, and my arterial tone was below par. My hearing was and is above the normal standard of acuteness, which fact I have often proved with a Galton's whistle. I parted with my annoying companion at the end of 1879. Switzerland I think cured me. Again in the summer of 1882 I had a great deal of night work. I happened to be staying in the country for a short time, and first discovered my tinnitus by getting out of bed in the morning to ascertain if the wind was high, as I knew

the night had been unusually fine. I found the rustling sound of waving trees existed in my ears. This latter tinnitus remained with me until the end of 1883. It troubled me very little in the day time and was aggravated when the meatus was closed or when the head lay on the pillow. During the time of its existence I had, on and off, a very slight naso-pharyngeal catarrh, and I believe my right Eustachian tube was occasionally in a state of partial collapse. My hearing was never in the least affected. Wilde took a very gloomy view of such cases of tinnitus, and prophesied a dismal end for those who suffered from noise in the ears while the hearing was acute. I hope and believe, from rather a selfish view, that the distinguished Irish aurist was not correct.

These observations are made from a table of 260 cases of tinnitus aurium culled from my private casebook.* I regret that there has not been time at my disposal to make it fuller; but even this, as I acknowledge, incomplete summary took a considerable time to compile and analyse. I propose first to briefly summarise the most important facts deducible from this table and analysis, drawing your attention to some interesting features of a few of the cases. I regret that I was not able to review notes of other than those of aural ailments. I should, for instance, have wished to have made a table of those affections of the eye which were accompanied by this symptom of tinnitus. This, however, was impossible in the time at my disposal, and I had to content myself with a search through patients who consulted me only for an affection of the ears. I may exemplify what I mean from the notes of a few cases I have included in

* The author presented to the otological section of the British Medical Association, tables containing the statistics of 260 cases arranged under the headings of *sex, age, ear affected, clinical conditions of ear found on examination, ascribed and recognised causes, symptoms.* (*British Medical Association, Annual Meeting, 1890.*)

this table, which I have taken from my ophthalmic casebooks.

A gentleman, aged fifty-three, consulted me for migraine and tinnitus; for twelve days previous to his visit he had suffered from diplopia. The noises he described as like a "steam engine, and a singing in both ears;" the left ear and hearing distance were normal; the right ear had been deaf for fourteen years, the watch not being heard on contact; there was pain in the head, more particularly across the forehead; the globe of the left eye was tender to the touch, and the tension was increased to +2. The papillæ of both eyes were hyperæmic to the point of neuritis; the membranes of both ears were normal, and no local changes were discernible in the ears; he had been a great smoker. Under treatment and local attention to the eyes, he lost the diplopic symptoms, but the noises continued.

A young gentleman, aged twenty, consulted me for cloudiness of vision. He was subject to facial neuralgia, and there was constant tinnitus in the right ear. The left ear was normal. The membrana tympani of the right ear was healthy; there was a collapsed state of the Eustachian tube; the watch was heard at about a foot. The right eye had been affected on and off for nearly ten years. The tuning fork was heard somewhat louder in the right ear when open, but much less so on closure of the meatus. There was advancing optic atrophy of the papilla of the right eye, and general hyperæmia of the left retina, with small blood extravasations at the margin of the papilla.

A lady, aged thirty, whose eyes had been what she termed weak, was attacked in the month of August with a loud tinnitus in the left ear. This was followed by dimness in the corresponding eye. When she consulted me in December of the same year, the vision of that eye

was reduced to the bare perception of the shadow of objects, and the vision of the right eye to perceiving 70 Snellen at 18 inches. The tension of both eyes was then + 3, and there was a glaucomatous papilla. Both ears were normal, and the hearing was in no way affected.

It would be absurd in a work of this nature to recapitulate all the clinical conditions met with in each case, and of which I had pretty full notes. Therefore, to save time, under the head of "Clinical condition," I simply include under "Catarrh, or catarrhal states of the tympanum," those evidences of middle-ear changes which result from chronic catarrhal states of the tympanum, including alterations in the shape, position, consistency, and mobility of the membrane, with or without adhesions; various ossicular changes, such as adhesions, rigidity, displacements; collections of mucus in the tympanum. The cases in which the symptoms as regards extreme deafness, inability to hear the tuning fork, vertigo, or other evidences, pointed with certainty to an affection of the labyrinth, I have included under the clinical head of labyrinthine deafness. I have thus subdivided the features of each case: Sex; age; ear affected, if only one or both; cause ascribed by the patient for the noise and deafness; the clinical condition and clinical symptoms.

The following were the noises I have recorded as complained of by patients. The sound resembling buzzing; sea roaring; trees agitated; singing of kettle; bellows; bee humming; noise of shell; horse out of breath, puffing; thumping noise; continual beating; crackling sounds in the head; train; vibration of a metal; whistle of an engine; steam engine puffing; furnace blowing; constant hammering; rushing water; sea waves; drumming; rain falling; booming; railway

whistling; distant thunder; chirping of birds; kettle boiling; waterfall; mill wheel; music; bells.

I should say from my experience that we may place the proportion of aural patients who suffer from tinnitus as about one in three.

Analysis of Table.—Sex: males, 127; females, 133. Ages: under ten, 3; ten to twenty, 36; twenty to thirty, 43; thirty to forty, 41; forty to fifty, 39; fifty to sixty, 35; sixty to seventy, 21; seventy to eighty, 8; not recorded, 34. The youngest patient under ten was three years old, the next, four, the other, seven. The causes ascribed in these cases were respectively, three years, nasal turbinal obstruction; four years, fever (possibly meningeal complications); seven years, tonsillar hypertrophy. The ears were normal in the child affected with tonsillar hypertrophy. There was absolute deafness in the patient attacked after fever. Right or left ear, or both: right ear, 36; left ear, 53; both, 171. Ascribed causes: cerumen* (present on examination), 30; nasopharyngeal catarrh, 28; nasal turbinate congestion and obstruction, 19; mental worry and overstrain, 14; sea bathing, 12; scarlatina, 9; heredity, 8; tropical effects, 8; the menopause, 8; injuries, 7; hypertrophied tonsils and tonsillitis, 7; abscess or inflammation of meatus, 7; cardiac disease, 7; gout, 5; uterine disorders, 5; measles, 4; syphilis, 4; alcohol, 4; rheumatic fever and rheumatism, 3; pregnancy, 2; morbus Brightii, 2; ozæna, 2; decayed teeth, 2; facial paralysis, 1; puerperal septicæmia, 1; quinine, 1; adenoid growths, 1; from gun concussion, 1; pneumonia, 1; parotitis, 1. In the remaining cases no cause was ascribed. In a few of the above there was a double

* Cerumen in these cases was the sole cause of the tinnitus, and it disappeared on its removal, or did so after some slight additional treatment.

causation ascribed; where this appears to have been of importance it has been included.

Clinical Conditions of Ear Found on Examination.—Cerumen, 30 (I do not include those cases of cerumen in which this condition was of secondary consequence, and evidently not the cause of the tinnitus); inflammation or abscess of the meatus, 7; exostosis of the meatus, 7; catarrhal changes in the tympanum (as above stated), 102; the same, with closed Eustachian tube, 20; collapse and obstruction of Eustachian tube, 38; perforation of the membrana tympani, 17; polypus in the tympanum, 4; disease in the labyrinth, 47; nasal obstruction from enlarged turbinate bones, deviation of septum, congestion of the Schneiderian membrane, &c., 19; tonsillar hypertrophy, 7; cretaceous membrane, 1; both ears normal, 26; one ear normal, 7.

Ascribed and Recognised Causes of Tinnitus in an Ear in which the Hearing was Normal.—Recent sea bathing; fever; alcoholic excess; tropical causes; cardiac weakness; nasal obstruction; puerperal septicæmia; irregular catamenia; mental strain; over-study; menorrhagia; Bright's disease; the menopause; albuminuria; quinine; retroflexion of uterus with neurosis; pharyngeal catarrh; neurotic temperament; tobacco.

The hearing distance was normal in *both ears* in 18 cases. In the cases in which this occurred the tinnitus was ascribed to overwork, alcohol, puerperal septicæmia, the menopause, residence in India, nervous temperament, overwork on the stage, hypertrophied tonsils, exostosis, albuminuria. No cause was ascribed for the tinnitus in three of these cases of normal hearing.

Symptoms.—The main symptoms complained of in 187 of the cases were tinnitus and deafness alone; in 22 vertigo was present, and in 9 of these the typical symptoms of Ménière's affection occurred—nausea,

vertigo, syncope, tinnitus, and deafness. There were accompanying ocular symptoms with associated retinal changes in 7; hyperæsthesia acoustica or hyperalgesia (Ross) in 1; paracousis loci in 2; and reduplication of sounds in 2. What the patients described as "crackling sounds in the head" occurred in 9; confusion of ideas was present in 2; insanity followed in 1 (there was a previous history of insanity in the family in this case). One patient complained that "every step she took she heard it in the left ear" (this symptom commenced after recovery from puerperal septicæmia); in one there was typical laryngeal vertigo, accompanied by a sense of choking on attempting to swallow. In one, in whom the deafness was only occasional, but the noise in the left ear and the side of the head was constant, facial paralysis of the left nerve was present. In another, tinnitus aurium was the first symptom (with slight accompanying deafness, which foreshadowed the future involvement, successively, of the nuclei of the auditory, facial, sixth, sensory of fifth and motor of fifth, and glossopharyngeal nerves. In one the deafness and tinnitus began after a railway injury. In the case of hyperæsthesia acoustica the patient said that "church bells set her wild," "the organ made her quite giddy," "the clock in the room was disagreeable," and "the sound of her brother's voice was peculiarly distressing." It is worth remarking, that of the 17 cases of perforation of the membrana tympani, of those cases in which both ears were chronically affected, no noise was heard in the perforated ear in 5 instances. In several of the others the perforation was either acute or complicated with other conditions. In 11 cases the tinnitus was only heard at night or became so aggravated as only to give great distress to the patient at night.

In the 13 cases of *simple vertigo* noted, the following

were the clinical conditions: (1) adenoid growths in pharynx; (2) perforation of right membrana tympani; catarrhal changes in left; (3) obstruction of the Eustachian tube; (4) labyrinthine deafness right ear; left ear normal (double optic neuritis present, migraine, diplopia, mydriasis); (5) polypus in tympanic cavity; (6) ears normal, hearing normal; (7) slight catarrhal effects in tympanum; (8) catarrh of tympanum and labyrinthine deafness; (9) hearing normal, inefficiency of cardiac syncope; (10) ears normal, hearing normal, deafness only occasional, facial paralysis present; (11) catarrh of tympanum and labyrinthine deafness; laryngeal migraine present; (12) polypus in the tympanic cavity; (13) chronic catarrh of tympanum (after sea-bathing and syringing on the membrane with cold water); tinnitus in the left ear, and tendency to fall to the right side.

In the 9 cases in which the more characteristic symptoms of *Ménière's vertigo* were noted, the following were the clinical conditions: (1) ears normal, gouty diathesis and systolic inefficiency; in this case the tinnitus was described in the right ear "as maddening;" (2) labyrinthine deafness; (3) labyrinthine deafness with neuralgic headache; (4) labyrinthine deafness left ear, right ear normal, patient of rheumatic and gouty diathesis; (5) labyrinthine deafness; the patient fell without warning to the ground with the first attack of vertigo, now constantly "rolls about as if drunk;" (6) catarrhal changes in tympanum; (7) collapsed state of membrana tympani, tinnitus and deafness only found in the left ear; right ear normal and its hearing normal; (8) chronic changes in tympanum (ascribed cause syphilis); (9) labyrinthine deafness; the first attack came on after recovery from an operation for hæmorrhoids; is liable to attacks in bed.

I shall delay you only a few minutes while I venture to remind you of the more important *points of anatomical interest that bear on the etiology of tinnitus*.

Anatomical.—First, there are the connections now shown to exist between the auditory nuclei in the medulla and pons, and the cortical auditory centres of either side of the brain. I think we may now look on it as absolutely certain, after the recent exhaustive Croonian Lectures by Dr. Ferrier, that “the sense of hearing is in greater part situated in the temporal lobe, and more especially in the superior temporal gyrus of this lobe.” As Dr. Ferrier remarks, in a letter to me on the subject, “tinnitus may occur in both ears as the result of unilateral irritation, the effect of the intimate connection of the auditory nerves and centres.” The cases of Sensory Cortical Discharges* reported by Hughes Bennett, may be advanced, Dr. Ferrier thinks, to establish this view. Ferrier states† that Baginsky says that the auditory nerve is in relation with the auditory centre of the cortex through the lower fillet of the opposite side, and thence by means of the posterior tubercle of the corpora quadrigemina and internal geniculate body to the medullary fibres of the cortex.

It is probable that lesions of the adjoining parietal and occipital lobes may encroach upon, invade, or inhibit the hearing centre and cause both deafness and tinnitus. The auditory nucleus in the fourth ventricle is connected with that of the facial and the trigeminus, and in close proximity to those of the vagus and hypoglossal. Some fibres of the nerve also arise from the superior vermiform process and pass out through the inferior cerebellar peduncle. It is important to remember that the anterior nucleus of the auditory nerve is supplied with vasomotor

* *Lancet*, 1890.

† Croonian Lectures, 1890.

fibres. I think we may thus classify the principal sources of reflex irritation or inhibition of the auditory nerve: (a) Through communications* at the nuclei of origin; more especially might this occur through the sensory fifth and tenth nerves. (b) Through the communications with the facial in the internal auditory meatus, the reflections from this connection being transmitted along the petrosal nerves from the otic and Meckel's ganglions, and the parts supplied by them. (c) Through communications between the nerves supplying the tympanic structures, and Meckel's ganglion and the otic and geniculate ganglions. According to Foster, the activity of the tensor tympani muscle is regulated by reflex action. (d) Irritations may be reflected to the cerebellum or the auditory centre and referred to the ear or different parts of the head. Most important are the researches of Gaskell as to the presence and course of vaso-constrictor and vaso-dilator fibres (which control the blood supply by constriction or dilatation of the small vessels) arising, the former from the upper part, and the latter throughout the whole length of the spinal cord, and which pass to the cervical ganglions of the sympathetic, and thence (in this instance) to the special arteries, furnishing the supply of blood to the ear, more especially the internal auditory from the basilar. Also, of importance is the fact that certain nerves, such as the trigeminus and cervical sympathetic, appear to be supplied with special "pressor" fibres (McKendrick), which have the power of constricting the vessels; this may occur either from a direct or reflected irritation of these fibres, which irritation, as in the case of the cervical sympathetic nerve must have an important effect on the circulation in the ear. Of the various other nerve communications

* See Chap. VI.

and distributions in the ear, which bear on reflex irritation, I would remind you of the connections between the glossopharyngeal, fifth, and sympathetic nerves, as, for example, the supply of the tensor tympani and stapedius from the otic ganglion and the facial nerves respectively; the communications in the tympanic mucous membrane, between Jacobson's nerve, the sympathetic, and the geniculate ganglion of the facial nerve, and the other communications between the carotid plexus of the sympathetic, Jacobson's nerve, and the otic and Meckel's ganglions, thus bringing all these nerve communications into direct relation with the superior cervical ganglion. The supply of the anterior wall of the external auditory meatus and the tympanic membrane from the auriculotemporal is an important point bearing on reflex irritation from affections of the external meatus, which cause tinnitus, when the middle ear is healthy. This sensory supply, be it remembered, is connected with the facial and pneumogastric nerves.*

Physiological.—I would now wish shortly to group the *abnormal physiological conditions* which are likely to cause tinnitus. With regard to the physiology of hearing, it does not appear that there are any proofs that separate centres exist for the perception of different kinds of sounds. A sensation arising from any irritation in the auditory centre may be referred to the periphery, that is, to the origin of the nerve filaments in the labyrinth (McKendrick). The receptive auditory centre is possibly in part situated in the cerebellum. An irritation occurring either in the labyrinth, the auditory nerve, or receptive centre, will, Professor McKendrick considers (in a communication which he has kindly written to me on this subject), “produce a stimulus in the hearing centre which will cause a sensation or a series of sensations which will always

* See p. 123, diagram of the connections of the trigeminus.

be referred to the labyrinth." Such irritations may be caused by anything that interferes with the normal equilibration of the fluid in the labyrinth, by any direct or reflected irritation of the nerves of the external meatus, the middle ear, or labyrinth. They may follow or attend on the presence of abnormal constituents in the blood which circulates in the receptive centre, as well as alterations in the blood supply due to increase or diminution of blood pressure. This latter condition, occurring either at the periphery, in the cerebellum, or in the course of the auditory nerve would be in itself sufficient to start an irritation of the hearing centre.

It has to be remembered, as Professor McKendrick rightly insists, how exquisitely sensitive the auditory nerve apparatus is, a fact with which all are acquainted who have studied the physiology of the ear in its perceptive powers, and its faculty of differentiating, analysing and synthetically arranging sound waves. Hence, how extremely feeble and imperceptible to the finest resources of the aurist, which he employs in diagnosis, may those causes of stimulation be which are yet sufficient to produce tinnitus. In one of my cases a loud tinnitus was complained of, which the patient said occurred quite suddenly while in the open air during harvesting. Resting on a perfectly normal membrane I found, on examination, the fine membranous husk of a hay seed, the removal of which completely relieved him.

There is nothing to show that we can strictly apply the hypotheses as to the *probable routes by which mere noises, as distinguished from tones or other regular series of vibrations, are transmitted to the brain*, through the vestibular or cochlear nerves respectively, to those varieties of sound, musical and other, which are heard in the case of persons suffering from tinnitus.

It may be that some explanation can be offered by

assuming that the nerve filaments of different portions of the basilar membrane were affected at the same and at different times in the same and in different individuals, so that the impulses arising from irritations of the nerve fibres supplying narrow or broad portions of the basilar membrane, and the superimposed elements of Corti (devoted to the transmission of certain waves of sound to the auditory centre) having different qualities of intensity, timbre, and pitch, would probably convey such sensations of sound as were ordinarily transmitted to them by normal stimulations of these same fibres due to the passage of sound waves through the air. Thus, the pitch of the sound heard and the character of the vibration referred by the hearing centre will depend upon the intensity of the irritation of the part of the cochlear nerve involved from base to summit, and we can further conceive such complex irritations as would be capable of producing the same impressions as result from compound waves of sound that make up or combine to produce musical tones and notes. Further, if it is, as it appears to be true, that the transmission of noise occurs through the ampullæ through the coarser elements of the crista acoustica, we may assume, when loud and harsh noises are referred from the hearing centre, that it has been through the terminations of the ampullar nerve that the irritations have been conveyed. McKendrick says: "The ultimate analysis of auditory sensations must take place in the auditory centre of the brain; each fibre of the auditory nerves that comes from the cochlea will be stimulated by the vibrations of its own hair cells, or set of hair cells, and each filament will conduct impressions proportional in number to these hair cells."* Then, as suggested by Rutherford,

* J. G. McKendrick, M.D., F.R.S., *Textbook of Physiology*, vol. ii., 1890.

different cells in the brain will receive varying numbers of nervous impulses, and the sensations of sounds of different pitch will be produced. We might reverse this order of things, and assume the irritation of certain groups of cells in the cortex as productive of associated impulses referred to the nerve filaments distributed to different portions of the labyrinth.

Or it may be that in the storage of memory of impressions in the sensory centre another explanation can be offered. In referring to molecular movements in the cells of the cortex arising out of impressions and the resulting reflex phenomena, Professor McKendrick says in his work "they may be called into action by a stimulus from another part of the brain, as when irritation of the corpora quadrigemina by Indian hemp awakens in the cells of the visual centres of the cortex those changes which are associated in the mind with long-forgotten visual impressions, and the person sees passing before him the phantasmagoria of brilliantly-coloured images."* It is conceivable that a stimulus of the receptive auditory centre may in like manner awaken old impressions and give rise to reflex phenomena of sound.

Vertigo.—It would be out of place in this paper to introduce any observations which might lead to a discussion on the physiology and etiology of vertigo generally, and the grounds for differentiating aural vertigo from those other forms which have been associated with mental, epileptic, ocular, laryngeal, pharyngeal, gouty, and gastric miasmatic causes of giddiness. The names of Trousseau, Charcot, Lasègue, Duchenne, Gueneau de Mussy, Abadie, Krishaber, Guye, and Weber-Liel abroad, and those of Ferrier, Gowers, Hughlings Jackson, McBride, and Woakes in England, are those we are most familiar with in relation to this differentiation.

* *Loc. Cit.*

I must simply limit these few observations to the aural vertigo which is associated with tinnitus aurium. A glance through my cases will show some important facts, which those who have previously written on this subject have noticed: (1) the origin of pharyngeal vertigo and tinnitus from adenoid growths in the nasopharynx (Guye); (2) vertigo due to disturbance of equilibration from tubal obstruction; (3) cerebral vertigo associated with optic neuritis; (4) vertigo and tinnitus in which the ears were normal, and the hearing distance normal, of a purely reflex or neurotic character; (5) vertigo and tinnitus due to inefficient cardiac systole; (6) vertigo with tinnitus due to facial paralysis—the hearing being normal—a reflected irritation probably from the geniculate ganglion; (7) labyrinthine deafness associated with laryngeal vertigo; (8) sea bathing associated with the origin of vertigo and tinnitus; (9) rheumatism and gout as causes of a vertigo due to labyrinthine affection; (10) the association of vertigo with nasopharyngeal morbid states (this fact is not shown in the tabular statement bearing on vertigo, as I have not here included the causes in those cases in which vertigo occurred); (11) the occurrence of vertiginous attacks when lying down in bed (the tinnitus in this case was not of the nature of an aural hallucination).

The discussion of Brenner's electrical formula in the diagnosis of hyperæsthetic tinnitus does not enter into the scope of this work, further than it reminds us of the fact that this cathodal and anodal influence on tinnitus may assist in diagnosing the hyperæsthetic, anæsthetic and torpid states of the auditory nerves in cases of tinnitus. Dr. Althaus has published some interesting cases in which he took advantage of the lessening influence of the anodal closure to cure a tinnitus of auditory hyperæsthesia.*

* *Lancet*, July 31, 1886.

I have not here referred to those *objective* noises occasionally present, and which are heard by others as well as the sufferer. I have dealt solely with subjective noises. Such objective sounds are usually associated with chronic middle ear changes. But even without the presence of these changes, as is well known (in the instance of Johannes Müller and the cases quoted by Mayer, Schwartze, Politzer and others) such objective sounds can be voluntarily produced by some individuals by contraction of the tensor-tympani muscle. Politzer and Luschka both attribute the voluntary production of such a snapping noise to separation of the walls of the Eustachian tube through spasm of the palatal muscles. All audible noises I have at any time heard, apparently in the ears of patients, were associated with movements of the palatal muscles. Such an audible cracking or snapping noise I can produce myself by certain gymnastic movements of the tongue against the hard palate during the first part of the first act of deglutition. Burnett, who writes the most complete and interesting summary of these objective noises, relates the particulars of a case in which he proved that they occurred in consequence of spasmodic movements in the velum palati at one side, and in another the "clicking" was associated with phonation, the only clinical feature of importance being hypertrophic turbinated bones. Such muscular spasms Burnett considers are produced by catarrhal irritations of the palatal or pharyngeal muscles, which in the effort to get rid of the irritant, are thrown into a state of chronic spasm, the sounds being caused by the vibrations in the muscular structure and are conveyed through the Eustachian tube to the middle and external ear.*

* Burnett, *Diseases of the Ear*. Churchill, London, 1890.

Certain disturbances in the equilibration of the labyrinthic fluid, or reflex irritations of any part of the nervous apparatus of the labyrinth, or irritation of the auditory nerve nuclei, may cause the symptom of vertigo to accompany that of tinnitus. Stimulation of the cerebellum or cortical auditory centres may have the same effect; such stimulations may be reflected; deafness is not necessarily an accompaniment of the vertigo under these conditions, nor is it absolutely necessary that there must be local aural changes discernible in those suffering from the symptoms portrayed by Ménière. The augmentation, however, of tinnitus, or its aggravated occurrence at the moment of the vertiginous attack has been looked on as pathognomic by Charcot. The latter authority speaks of a vertiginous state in which the paroxysms are more or less constant, occurring by night, alike in the dorsal decubitus as in the vertical position. I have at present a patient under my care who is subject to very severe attacks at long intervals, some of these occasionally occurring in bed. He has an old and large perforation of the membrane in the left ear, and catarrhal changes in the right, the hearing of which is still fair; he does not suffer from tinnitus constantly, and associates the first attack of aural vertigo with his recovery from an operation for internal hæmorrhoids. Severe sickness attends on the paroxysms. In simple aural vertigo "the giddiness, the noises and deafness go hand in hand, and disappear at the same time, when the original cause of the trouble is removed; but in Ménière's affection the deafness increases when the vertigo becomes more rare." This accords with my experience, and is the opinion of Leroux.*

Ladreit de Lacharrière† would limit true Ménière's trouble to those cases in which there is labyrinthine

* *Dict. Encyclo. des Sci. Med.* † *Dict. Enclo.*, Art Oreille.

hæmorrhage, and Leo* says it is the severity of the deafness which differentiates the vertigo of Ménière from simple aural vertigo. The case of leukæmia, attended by symptoms of vertigo, ocular migraine, sudden deafness and tinnitus, reported by Politzer at the Otological Congress at Basle in 1885, is of extreme interest ; the patient died of leukæmic conditions of the liver, spleen, and the lymphatic glands, and suffered from albuminuria, with increase in the relative proportion of the white blood corpuscles. Besides the middle ear morbid changes, the cochlea and semicircular canals were filled by organised exudations, some of a recent leukæmic character. The auditory nerve fibres were swollen, and the nerves of the modiolus and the spiral lamina were passing through a fatty degenerative change ; blindness accompanied the deafness in this case. The whole report of the symptoms appears to closely simulate the progress of a pernicious anæmia. The causes appeared to have been, in the first instance, miasmatic : and secondly, syphilitic.

In any summary of the etiology of tinnitus no one can omit a reference to the valuable suggestions and practical observations which have been made by Dr. Woakes as to the effects of nasal complications in causing both deafness, tinnitus and vertigo. His view of the part played by the cervical ganglia in its influence on the arterial supply of the labyrinth, are true practically, and quite in accordance with physiological fact and experiment. At the same time, I do not go quite so far as he does in regarding the irritable and obstructive conditions as so very frequent a cause of tinnitus and vertigo. However, even from my table of cases, the correlation between tinnitus and nasal and nasopharyngeal morbid states is evident. Nor can I omit an allusion to the valuable work done by

* *Thèse de Paris*, 1876.

Weber-Liel, Hartman, and others bearing on the part played by the tensor tympani muscle in the production of tinnitus, and the results which they have recorded, familiar to all, which follow section of the tendon of that muscle. The absence of tinnitus in the majority of cases of perforation of the drum of the ear, often even with absence of the ossicles, is a fact which bears on the justification of the operation now performed for removal of the auditory ossicula in cases of tinnitus, and certainly may be advanced as an argument in favour of this step (Sexton, New York).

The following classification may be taken as a basis for a classification of the different causes and varieties of tinnitus aurium.

Class 1. Impulses originating in the temporal lobe, or superior temporal gyrus, the cerebellum, or the auditory nuclei (in the medulla or pons), and referred as impressions to various situations, as the labyrinth or certain parts of the head.—Such acoustic impressions may or may not be attended by deafness. These impulses may be associated with lesions in these areas—as tumours, apoplexies, effusions, thrombi, or possibly lesions in the adjacent portions of the occipital or parietal lobes. Such impulses may result also from reflected irritations of any of these parts.

Class 2. Impulses due to irritation direct or reflected in any portion of the auditory nerve.—This latter would include hyperæsthesia, atrophy, sclerosis, traumatism, vasomotor (dilator or constrictor) effects, morbid blood supply to the nerve, as in uræmia, anæmia, or the circulatory changes which occur during pregnancy. These latter causes may also operate under Class 1.

Class 3. Impulses originating in the peripheral ends of the auditory nerve, due to (*a*) Increase or diminution of labyrinthine pressure; increase or diminution of, or

encroachment upon, the perilymph or endolymph, from abnormal pressure on either of the fenestræ; this latter cause would include rigidity of the membrane of the round opening, and fixation of the stapes against the oval opening. (b) Vascular changes—increase or diminution of blood-pressure, frequently associated with cardiac disease—hyperæmic, anæmic, or toxæmic states of the blood circulating in the labyrinth; apoplexy, and extravasations. (c) Morbid nerve conditions—hyperæsthesia, paresis (organic or functional), atrophy, sclerosis, traumatism. (d) Rheumatic, gouty, or syphilitic states of the walls and vessels of the labyrinth. (e) Reflected disturbances through the spinal cord or cerebro-spinal nerves, as occurs in uterine disorders, pregnancy, gastric derangements, disorders of the liver, flatulence, spinal neuroses, dental, nasal, and ocular irritations involving the fifth and facial nerves.

Class 4. Irritations arising from interferences with the intra-tympanic muscles—tensor tympani and stapædus.—Such interferences would include any spasms of these muscles—abnormal changes in the membrana tympani or the mucous membrane of tympanum—reflex irritation transmitted from the facial or trigeminal nerves.

Class 5. Irritations transmitted by altered conditions of equilibration of the air in the tympanic cavity.—This would include enervation of the tubal muscles of the Eustachian tube, and altered relations between the air in the tympanic cavity and the blood in its vessels or those of its membrane; also pathological states of the membrane.

Class 6. Irritations due to disease in the middle ear and labyrinth.—This would embrace atheromatous changes in the arteries, aneurysmal dilatations, blood extravasations, venous congestion within the lateral sinuses,

disease of the mastoid cells, and disease of the petrous portion of the temporal bone, exudations and tumours.

Class 7. Irritations arising in the external ear—including inflammation and abscess, ceruminous collections, eczematous inflammation, exostosis and hyperostosis, othæmatoma, foreign bodies. Some of these causes act by direct irritation of the nerves supplying the external auditory meatus or tympanic membrane, as in inflammatory attacks and exostosis; others, as cerumen or foreign bodies, by the influence they exert on the sound waves, or by the pressure due to their presence on the membrana tympani, and thus conveyed to the ossicles and labyrinth.

Class 8. True aural hallucinations, subjective impressions arising in the psycho-sensorial brain centres, and having no objective cerebral or aural source of origin. Such hallucinations may become insane hallucinations. The latter may be divided into two distinct forms. (a) Hallucinations which arise subjectively in the brain when the aural apparatus and auditory nerves are healthy. (b) Hallucinations which are secondary to objective changes in the aural apparatus, and in which a tinnitus is developed that leads up gradually to a fixed illusion. It is essential always to keep such hallucinations or aural illusions apart, as phenomena quite distinct from tinnitus. They are analogous to ocular illusions or spectra. I refer to “heavenly voices” or “music”—a symptom associated with epilepsy and hysteria. The same observation applies to “alcoholic psychoses.” The entire auditory apparatus is healthy, and the hallucination is quite independent of any acoustic trouble. That able psychologist, Dr. Ringrose Atkins, Resident Medical Superintendent of the Waterford Lunatic Asylum, in writing to me, says, in regard to the relation of tinnitus to insanity:—“Instances do

occur where what was originally a tinnitus, depending on some morbid state of the aural apparatus, may even-tuate in a condition of hallucination. That is, the individual so affected may, from a lowered state of the nervous system, or as the result of long-continued irritation, come to consider the subjective noises as real, and depending on external causes, and they may act thereon." This would constitute an insane hallucination, though it might not depend on any morbid condition in the psycho-sensorial brain areas. This, I believe, is exactly what occurred in the case included in my tables. After marriage the lady fell into ill health; she became despondent about her ear, and the noises which were present; gradually she developed delusions with regard to the ear, screaming violently and being with difficulty controlled; this state gradually merging into one of ordinary dementia, but in which the prominent idea was that the ear was the source of all her trouble. "I have known," says Dr. Ringrose Atkins, "a woman in no way insane who, as the result of tinnitus, firmly believed that an insect had entered into her ear and penetrated her brain, and that it was constantly biting the latter, as she heard it within. The morbid belief raised the purely somatic subjective sensations to the level of an 'insane hallucination.'" He also cites a case in which "a man who was in a condition of deep depression from tinnitus, which took the form of 'crackling' all over his head, and which was well nigh unbearable." In one case of mine in which this "crackling noise" was heard at the right side of the head, the patient was rather dubious of my own hearing power because I did not hear the "crackling." Here another suffered from athetosis. In another, in whom the ear and brain were normal, there was complete blocking up of both nostrils, through turbinal enlargement.

Class 9. Therapeutical causes of tinnitus aurium. The action of such drugs as ergot, nitro-glycerine, alcohol, ether, quinine, salicin, caffeine, apomorphine, nitrite of amyl, tobacco, iodine, iodoform, chloride of barium, digitalis, convallaria, atropine, veratrin, duboisin, gelsimin, jaborandi, pilocarpine, monobromide of camphor, hydrobromic acid. Some of these drugs may act by direct stimulation of the auditory nuclei in the medulla, as caffeine, gelsimin, iodoform, salicin, and quinine; others, as digitalis, jaborandi, nitrite of amyl, chloral hydrate, by their action on the vaso-motor centre. Others, as quinine and digitalis, convallaria, by their secondary effects on the auditory circulation through their action on the heart. Quinine, I believe, occasionally causes such vascular conditions in the labyrinth as to bring about symptoms of Ménière's affection. Elsewhere I have given examples of this. But I cannot say, after my long experience of the use of quinine in all forms of fever, and in very large doses, during eleven years' work in a fever hospital, that to quinine, as a rule, we can attribute much permanent harm to the auditory apparatus. The tinnitus of fever is almost invariably transitory. That is my experience.

Dr. Buzzard, to whom I am indebted for an interesting paper, which he read before the Harveian Society (Lancet, January 25th, 1890), draws attention to the occurrence of vertigo without deafness or tinnitus as a consequence of central irritation. In the cases in which there is no deafness or noise in the ears (such as those instanced by him), he attributes the faintness and giddiness to irritation of the nucleus of the vagus, the auditory nucleus and the vaso-motor centre in the bulb. He instances those cases of paroxysmal deafness with tinnitus in which there is vertigo, as cases not of organic affection of the auditory nerve, but of functional central disturbances. Such disturbance may depend upon the presence in the blood of some such irritating ingredient as uric acid or urate of soda. There can be no doubt that we do meet with such cases, and not unfrequently, in which we have no evidence of any organic lesion in the auditory nerve, yet in which the characteristic features of Ménière's affection are present. Dr. Buzzard quotes some interesting cases confirmatory of this view.

CHAPTER II.

DIAGNOSIS. EXAMINATION OF A CASE OF TINNITUS.

Examination of the Case.—The first step to a diagnosis of the variety of tinnitus we are called on to treat is a thorough examination of the patient. In a small *brochure* of this kind it is not possible to attempt more than a general survey of the steps of such an examination.* Readers must consult a more exhaustive treatise for minute details of a systematic examination of the ear and naso-pharynx. Here it will answer my purpose to briefly summarise the investigation the practitioner must make before he can arrive (approximately) at the true seat and source of a given tinnitus.

Without enumerating all the appliances which the fully-equipped aurist will have at hand to conduct such an enquiry, I may with benefit mention those that are at least essential to the practitioner for the purpose of diagnosis. I assume he is provided with an ophthalmoscope, stethoscope, and some ready means (in the absence of an æsthesiometer) of testing the degree of sensibility of different regions of the body and determining the presence of anæsthesia or analgesia.

For the examination of the ear and naso-pharynx he will require—

* See the Author's *Practitioner's Hand-book of the Ear and Naso-Pharynx* for full details of, and the appliances necessary for, the examination of an aural case (fourth edition in the press). J. & A. Churchill & Co., 1887.

An aural speculum (a Siegle's speculum will also be of great advantage).

A few tuning forks (of different keys).

A Politzer's inflator.

A few Eustachian catheters.

A small bag with tubing attached to fit the catheter.

A tongue depressor.

A laryngeal reflector.

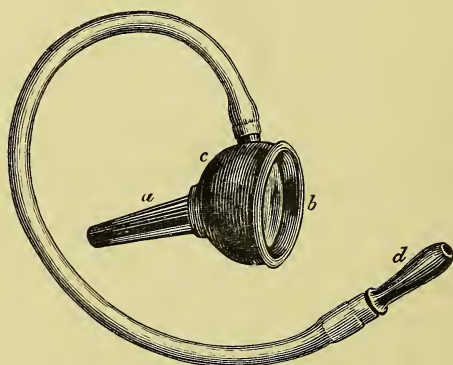
A rhinoscopic and laryngeal mirror.

A nasal speculum.

Nasal bougies.

An aural syringe.

FIG. 1.

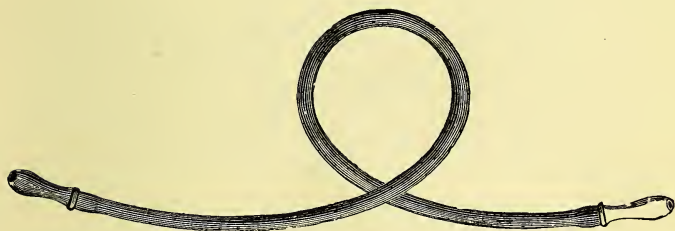


Siegle's speculum.

Testing the Hearing.—For testing the hearing distance the watch may be used. Few practitioners are likely to have either an acoumeter (Fig. 3), or a Galton's whistle. Therefore the hearing must be tested by the watch. The distance this latter can be heard with a normal ear should be noted, say 100 inches, and the hearing power marked as $\frac{1}{100}$, $\frac{2}{100}$, $\frac{1}{80}$, $\frac{1}{10}$, and so

on. The fact of the patient being able to hear general conversation at a dinner table, or the ticking of two clocks in the same room, or the fact of his hearing better in a railway train, should be noted. He should be tested blindfolded, or by the surgeon standing *behind* him, and he should not see the watch, or other means of testing, employed as it approaches the ear. There should be absolute stillness in the room in which the examination is made. The direction in which the hearing is most acute should be noted, and the comparative hearing of both ears accurately recorded at the time.*

FIG. 2.



Auscultation tube (otoscope.)

History.—The following points have to be noted :—

Age.—Ascertain the patient's age.

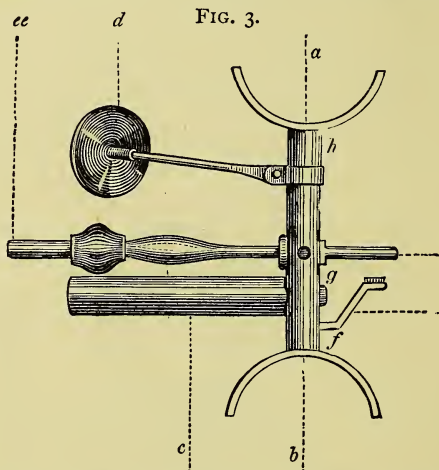
Ears affected.—If the deafness occurs in one or both ears.

Tinnitus. If there is tinnitus in one or both ears ; if deafness preceded the tinnitus, or *vice versâ* ; the nature of the tinnitus when heard loudest ; if constant, or if it disappears entirely or only partially ; if it is heard loudest at night and in the early morning ; if it is affected by closure of the meatus, or by pressure anywhere.

Ascertain the condition of the patient's health before

* See Appendix, p. 141, for the observation of Dr. Alexander Ogston on examination of the hearing ; also his remarks on "touch" deafness and tinnitus in certain cases of labyrinthine effusion.

the first occurrence of the tinnitus. Has the sufferer had much night nursing, mental worry, over mental strain, any acute illness, any injury, or much railway travelling? Is he subject to gout or rheumatism? Is there a family history of deafness, and can either gout



The acoumeter is useful for testing the hearing at long distances, say to twenty feet; also the movable plate *d* enables us readily to test the comparative conductivity to sound of different bony points about the ear. Politzer's acoumeter; *a* and *b*, semicircular vulcanite ends of pillar for forefinger and thumb; *h*, vulcanite pillar; *c*, steel cylinder; *e, e*, steel lever hammer; *f*, vulcanite check on which to press the lever hammer; *d*, brass plate at end of steel pin (which in the recent instrument, screws into the vulcanite pillar at *h*, and can be moved backwards and forwards through it). In the improved acoumeter the vulcanite pillar and check plate are made of one piece.

or rheumatism be said to be family heritages? Is he subject to frequent colds in the head, nasal catarrh, or has he habitually a relaxed throat? Is the breathing through the nose obstructed? Does he habitually sleep with the mouth open? Has he been a bather in sea

water, and has he been in the habit of diving? Does he suffer from cold feet and languid circulation?

Vertigo.—Has he attacks of vertigo and what is the nature of these? Are they attended by nausea or active vomiting? What was the nature of and under what circumstances did the first severe attack of vertigo occur? Is there pain in the head, or has there been any pain in the region of the ear associated with these attacks? Are the attacks frequent, and is there any aggravation in the severity of the tinnitus preceding or succeeding them? Are there any attendant ocular or laryngeal symptoms? Has the patient a tendency to fall forwards or to either side? Do the attacks ever occur in bed?

Other matters of importance relating to the general health.—Does the patient suffer from carious teeth or dental neuralgia? Has he had any chronic or severe illness? Are there any evidences of gross changes in the nervous system anywhere? Has he had *syphilis*? What is the condition of the urine and what the habit of bowel?

Examination of the Ear.—This involves—

- (1) Careful testing of the hearing of both ears.
- (2) Examination of the meatus with the speculum.
- (3) Examination of the membrana tympani.
- (4) Use of the otoscope and determination of the state of the Eustachian tubes.
- (5) Examination with the tuning fork.
- (6) Examination of the nasal cavities and nasopharynx.

Examination of the *heart*.

Examination of the *retina*.

Examination of *urine*.

In any case in which there are attendant oculo-motor symptoms, evidences of spinal myopathies, anæsthesia, or hyperæsthesia, or paralysis, a note should be taken

of these symptoms and the patient tested for an associated central or peripheral nerve lesion.

Before referring to a few special matters of detail in the steps of such an examination, it may be well to summarise the points it serves to elucidate—

Light thrown on the case by Preliminary Examination.—It will shew the bearing which the occupation and habits or general health of the patient have on the occurrence or the persistence of the tinnitus. It will indicate the probable source of the tinnitus in a local (aural) abnormal condition, or in some constitutional or systemic affection. The examination of the ear should decide the character of any local condition which is most likely to cause the tinnitus, whether in the external, middle, or internal ear, or possibly in two or all of these portions of the organ of hearing. The occurrence of vertigo and its relation to the hearing of the patient, when taken into consideration with other features of the case, and the response given to the tuning fork (applied in the proper manner) will help, if we can exclude both external and middle ear affections, to locate the source of the tinnitus in the labyrinth or in the course of the auditory nerve. The fact that there is normal hearing, though tinnitus be present, points to some extra-aural source of the symptom, not infrequently to be found either in an increase or diminution of vascular tension or abnormal state of the turbinate bodies.

The associated symptoms—tinnitus, deafness, vertigo and nausea—may pretty surely, though not certainly, be taken as evidence of Ménière's affection. It must be remembered that this same group of symptoms may be due to an intra-tympanic growth, or may be attendant on a cerebral apoplexy or tumour, though in the latter case we should most likely have confirmatory evidence in correlative affections of the parts supplied by

other cranial nerves, or some peripheral nervous lesion which would assist us in localising the central one. A tinnitus in a case in which the hearing is not affected will at once indicate the necessity for a cardiac examination. It may, for instance, be associated with general anæmia, and the attendant hæmic murmurs will help to explain the cause of the tinnitus as being located in the vessels of the labyrinth. An inefficient systole and the frequent attendant irregularities of rhythm, are not uncommonly found in these cases of overworked and worried men and women. Here a "pulsating" tinnitus, such as that I referred to in my own case, is occasionally complained of, always worse on first lying down at night or on awaking in the morning, and frequently disappearing during the daytime. Such a tinnitus may be materially modified or altered by pressure made under the ear, behind the condyle of the jaw, or over the vertebral artery in the suboccipital space. Again, both aortic and mitral insufficiency are attended at times by tinnitus. Also, a tinnitus with unimpaired hearing is often present (generally the sound being of a low hissing or rustling character) in slight catarrhal conditions of the naso-pharynx in which the respiration through the nose is obstructed, especially at night, when the patient has a tendency to sleep with the mouth open. The same may be said of cases in which we find slight congestion and hypertrophic enlargement of the turbinate bodies.

The exploration of the nose is absolutely necessary in every case of tinnitus, save those in which the cause is obvious, as in the case of a foreign body in the meatus. And even in gross middle ear changes we may find the key to their causation in abnormalities of the nasal septum or the turbinate bodies. In a similar manner our diagnosis will be assisted or verified by a careful examination of the naso-pharyngeal and palato-pharyngeal

regions. The presence of adenoid growths, thickening of the pharyngeal tonsil, generally relaxed states of the mucous membrane, hypertrophied tonsils, follicular engorgements and hypertrophies, parietic conditions of the palate muscles—all will help to throw light on the cause of the tinnitus.

Details of Examination.—We may now with advantage enter more particularly into the details of the examination of a patient suffering from tinnitus.

Having taken the history of the case as already described, we proceed to examine the ears.

1.—We test the hearing power of both ears carefully.

2. *Speculum.*—We examine with the speculum the meatus and membrana tympani—the meatus for foreign bodies, cerumen, dead epithelium, gouty discharge, mycosis, exostosis and hyperostosis, polypus, inflammatory states; the tympanic membrane for evidences of displacements, thickening, rigidity, collapse, cohesions, perforations, polypus (intra-tympanic growths and discharges).

*Otoscope.**—With the otoscope we corroborate our examination of the tympanic membrane with the speculum, determining the degree of patency of the Eustachian tube, the response of the membrana tympani to inflation by Valsalva's method, and noting the nature of the sound heard with the otoscope, viz., whether indicative of dryness or moisture, or conveying the comparatively loud and sudden flap sound of the collapsed drum head. We may at the same time verify doubts as to the presence of a minute perforation, the patency of the Eustachian tubes, the effects on the hearing and the tinnitus from inflation of the tympanum with air, by the use of Politzer's bag.

3. *Tuning Fork.*—We test the patient with the tuning

* I adhere to this name originally given to the auscultation tube, though some authorities justly object to this tube being so called.

fork. We have already decided with the acoumeter or watch whether the vibrations of sound are conveyed through the air, or only conducted through the cranial bones by contact of the sounding body with these. We contrast relatively with tuning forks of different pitch,

FIG. 5.

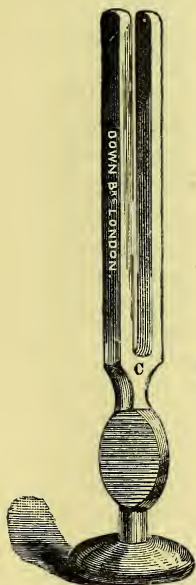


FIG. 4.

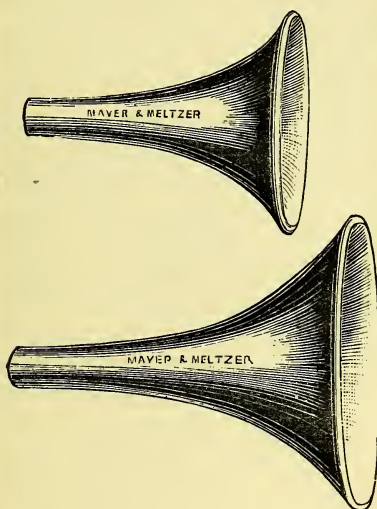
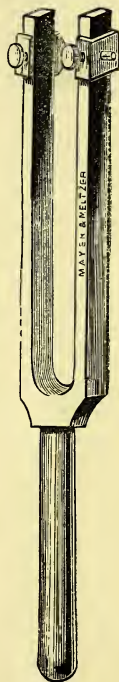


FIG. 5A.



Aural Speculum and Tuning Forks.

the perceptive power of the ears, comparing also the point of cessation of the perception of the abnormal with the normal ear. We try the tuning fork placed on the

summit of the head and over and behind the auricle, with the meatus open and closed. We ascertain if closure of the meatus influences the intensity of the sound. Such an examination assists materially our diagnosis. Its importance is based on certain acoustic facts:—

1.—A tuning fork placed on the head of a person with perfectly normal hearing is heard equally well in both ears.

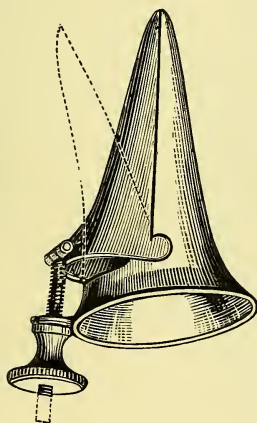
2.—Closure of either meatus intensifies and appears to bring the sound to the ear thus closed and to concentrate it in this ear. In the case of cerumen in the meatus, or mucus in the cavity of the tympanum, or other simple cause preventing the exit of the vibrations through the outer ear, the sound is heard loudest in the deaf ear previous to closure of the meatus, which act influences it but little, if at all.

In the case of labyrinthine deafness the sound of the tuning fork may be heard in both ears, but it is generally of unequal intensity. It may be heard but faintly or not at all in one ear, and closure of the meatus makes little difference, in fact generally lessens the sound. Advanced auditory nerve deafness prevents either acoumeter, watch, or tuning fork being heard when placed on the bones of the head. They still may be heard in some cases through the teeth.

There are, however, exceptions to these phenomena. One could multiply indefinitely the deviations from the usual responses to the tuning fork test in normal ears, and in cases of middle and internal ear deafness. For example, a little time since this curious case came under my observation. A gentleman aged fifty-five had for some years gradually been growing deaf. He had been under different aural surgeons. There was deafness of both ears with constant tinnitus, like “the blowing of

steam." The watch was not heard in either ear on contact ; the sound of three different tuning forks was not heard, but *the vibrations were "felt in the head"* when any one of the three was placed on any part of it. The acoumeter was heard faintly on the mastoid. Yet this gentleman declared that he could tell the inner from the outer portion of a target in rifle practice when the bullet struck it. I laid the tuning fork on the mastoid where the acoumeter was heard, but no note or sound was distinguished.

FIG. 6.



Duplay's Nasal Speculum.

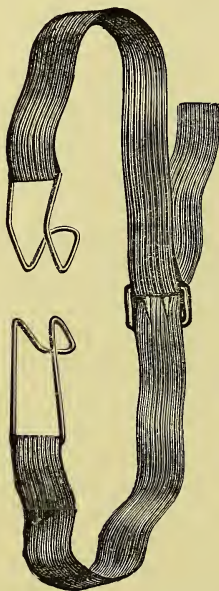
But though there are exceptions to the usual responses to the tuning fork test, in arriving at a diagnosis we may be influenced by these results.

1.—The vibrating tuning fork is heard at a given distance and for a given duration of time equally well in both ears when held in front of the meatus—both ears are probably affected alike.

2.—It is heard equally well in both ears when placed on different parts of the head—condition is equally good in both ears.

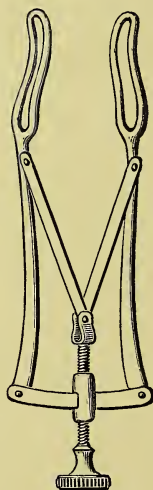
3.—It is heard better in one ear than the other when it is placed on the head, the meatus of both ears being open. That ear in which it is heard loudest may be the deaf ear (generally when there is some impediment or accumulation in the cavity of the tympanum, as mucus), or it is the better hearing ear when generally

FIG. 7.



Cresswell Baber's Nasal Retractor.

FIG. 8.



Frankel's Nasal Speculum.

there are in the other ear some grave middle ear or labyrinthine changes. Sometimes, in this latter case, closure of the meatus makes little difference, or the tuning fork is then heard less loud.

4.—It is heard faintly in both ears and closure makes no difference or deadens the sound. The labyrinth is affected with probably gross middle ear changes, ankyloses, stapedial fixation, &c.

7.—It is not heard in one ear either (*a*) in front of meatus, or (*b*) on the bones of the cranium. The labyrinth of that ear is generally affected.

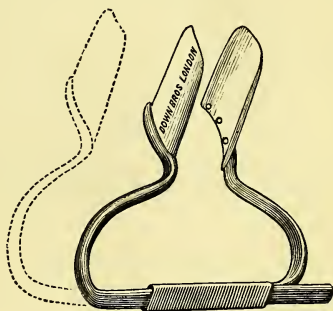
8.—It is not heard in either ear in similar situations and positions—generally both labyrinths are affected.

FIG. 9.



Thudichum's Nasal Speculum.

FIG. 10.

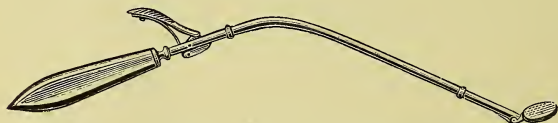
Modification by Lennox Browne,
for self-retention.

The Nose.—We next proceed to explore the nose. For this purpose we employ a Duplay's, Thudichum's, or Frankel's speculum (Figs. 6, 8, 9). Duplay's will be found the best to use in ordinary practice (Fig. 6).

We examine the septum for any tumour, skin exostosis or deviation; the turbinate bones for hypertrophy, growths, tumours, erections or adhesions.

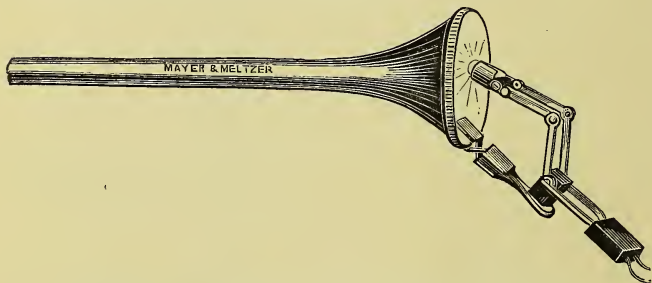
A careful investigation of the nares should be made and the condition of the mucus membrane as well as the character of any secretion noted. This will include in some cases an examination of the posterior nares with the rhinoscopic mirror (Fig. 11), or with the finger.

FIG. 11.



Zaufal's Rhinoscopic Mirror.

FIG. 12.



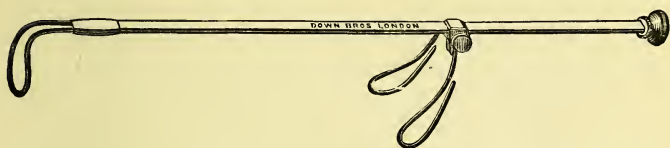
Zaufal's Nasal Speculum, with electrical illumination.

Throat.—Having thus satisfied ourselves as to the possible source of any reflex excitation in the nasal cavities, or any direct influence on the ear that might be consequent upon nasal obstruction or stenosis, we proceed to examine the mouth and pharynx.

Mouth and Pharynx.—In the mouth, carious teeth are taken note of, while in the pharynx the condition of the

tonsils, the state of the pharyngeal wall and the tonicity of the palatal muscles in phonation, are determined.

FIG. 13.

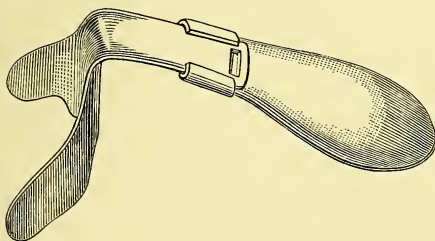


Palate Lever, American pattern, as modified by Mr. Cresswell Baber.

Heart and Vascular System.—In all cases of migraine, syncope, or any vertiginous affection accompanied by tinnitus, the heart, the great vessels and the conditions of the radial pulse should be examined.

The Nervous System.—Roughly speaking, this first survey will include examination of the knee and ankle reflexes; the condition of the retina; oculo-motor symptoms; signs of paresis or motor disorders, hyperæsthesia or anæsthesia; affections of the nerves of special sense;

FIG. 14.



Tongue Depressor and Lip and Cheek Retractor.

contractions, contractures or spasms, atrophic muscular changes; localised neuralgia; hallucinations; reflex neuroses; vaso-motor disturbances; pain (its seat and character).

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CHAPTER III.

DIFFERENTIAL DIAGNOSIS.

HAVING thus briefly enumerated the steps necessary to pass the patient through in examining the ear, and having searched for any extra-aural causes of tinnitus, we are in a position to approximately determine the class or classes under which we include the particular case before us. It is difficult in many cases to do this accurately and with confidence, but in a very large number of patients we can come sufficiently near the reference of the individual case before us to a special class, or it may be the border-land of two distinct classes of tinnitus, to enable us to give a correct prognosis of the chances for or against recovery, and to indicate the correct line of treatment to be pursued. To return to the etiological classification I have tentatively laid down, we may recapitulate the grounds on which, by such an examination, we include this or that case under any of these heads.

Class 1.* Most of those who would come under Class 1 are likely to have some evidence of the implication of the other nerves of sense in reflex disturbances, in muscular paresis, cutaneous anæsthesia or hyperæsthesia, or in oculo-motor symptoms and pupillary changes. Such causes as apoplexies, effusions, thrombi, or cerebral lesions, acting by inhibition, are most likely to reveal themselves in objective signs in the parts in

* See p. 20 for Differential Classification.

correspondence or associated with these cerebral centres. It is probable that in such reflected excitations we have an explanation of a tinnitus without deafness, as in cases of dental caries, dental periostitis with neuralgia, spinal tabes, uterine disorders, as versions and flexions, and in the functional sexual disorders of the menopause or pregnancy (though in the latter it is more often to be attributed to arterial tension and hæmic changes).

Class 2. We may expect to find similar symptoms to those referred to in Class 1 with more direct evidence of a lesion or excitation in the auditory nerve itself. In hyperæsthesia, the hyper-sensitiveness and pain attendant upon certain sounds, as pointed out in the peculiar case (page 8), I have already referred to, though there may be normal acuteness of hearing; in traumatism, the history of some injury, as a blow on the ear, a railway collision, a nasal fracture; in sclerosis and atrophy, the absolute deafness and the negative response to the watch or tuning fork, even by conduction, added to the history of pre-existing aural symptoms and progressive deafness or possibly vertigo; in irritation of the vaso-motor centre, vaso-motor disturbances of the labyrinth due to reflected excitations arising in the spinal cord or in the nuclei or branches of the fifth nerve (*vide* page 120), with all their evidences, in spinal neurosis, spinal and ganglionic irritation, oculo-motor symptoms, visual disturbances, gastric crises, headache, possibly thyroid changes, flushings of the face, eruption of the wisdom teeth, dental neuralgia and associated dental affections, ocular and laryngeal migraine.

Urine of low specific gravity, with a radial pulse of high tension, albuminous urine or that charged with excess of uric acid, the characteristic uræmic complications with the associated altered blood of pregnancy, require only to be remembered as coming under this class to secure their detection on examination.

In Class 3 we confront more clearly local causes of the tinnitus. Such peripheral auditory nerve excitations are usually associated with some abnormal states of the middle ear or the membrana tympani. These, in a case of diminution of labyrinthine pressure from changes in the perilymph or endolymph with accompanying rigidity of the round membrane or fixation of the stapes, have most frequently as their consequences, tinnitus, deafness with vertigo, and often nausea. The ossicula frequently are involved, the joints are ankylosed, the membrane is fixed, its pockets are altered in shape; the malleus is sharply defined, or if the case be an old one its head alone is visible, the normal division of the membrane into pockets is absent, the pyramid of light is either blurred or imperceptible, and the membrane may have lost its translucent look. But at other times this is not so, and with clear evidence from the tuning fork and acoumeter that the auditory nerve is affected, the membrane preserves its translucency, and there is but little deviation from the natural appearances. Then there are the cases in which a fair degree of hearing is preserved, and still we have tinnitus and possibly vertigo super-added. There may or may not be local evidences of gross middle ear changes. Here we at once suspect vascular tension, increase or diminution of blood pressure, and we search for evidence of organic cardiac changes or altered states of the circulatory fluid in anæmic or hyperæmic conditions. The urine requires to be carefully tested, and such toxic states as are likely to influence vascular tension may be detected. Such toxic or hæmic sources of tinnitus are frequently the forerunners of deafness and the occurrence of Ménière's symptoms following on extravasations and apoplexies. Aural vertigo rarely occurs without the associated "noise in the ears." The first attack may occur suddenly and

without previous warning, but generally there has been some pre-existing tinnitus with impairment of hearing.

Class 3. Peripheral lesions in the labyrinth are often attended with loud noises, and not unfrequently the patient will describe two or three different kinds of noise, one of which is a musical tone or note. But we look in vain in these cases, as distinguished from those in Classes 1 and 2, for any evidence of serious cerebral complications or such causes as uræmia, anæmia or pregnancy. Gout and rheumatism occasionally may cause tinnitus, but this symptom is associated with evidence of gouty changes in the meatus or on the membrane, and the uric acid diathesis is manifested by the evidences of gout elsewhere in the body, and the presence of free uric acid in the urine. A pasty meatus, shedding of epithelium, and possibly a slight discharge are often seen in such gouty cases. Also we may find on inspection that some cretaceous deposits have occurred, which are seen as irregular white coatings on the membrane. Such cretaceous masses I have occasionally observed in gouty patients (there are some typical representations in the author's "*Atlas of Diseases of the Membrana Tympani*").* I must say that in my experience I have rarely found tinnitus and deafness (arising from changes in the middle ear) as a result of syphilis. This is not so true in the case of the labyrinth. If they are caused by specific disease there are other signs of syphilis present, most probably in the skin or palate, and pharynx, or the nose, and there is the history of a past syphilitic attack. Mere reflected disturbances of the labyrinth which arise in uterine disorders, during pregnancy, in various forms of dyspepsia, hepatic congestion, flatulent distension of the bowel, or in various visceral neuroses, obviously form but one of the groups of symptoms which are met with in such conditions.

* J. and A. Churchill, London.

More particularly has it to be remembered that tinnitus has its possible origin in dental irritation, in astigmatism and associated asthenopia, in nasal turbinate abnormalities, since such starting points of excitation are specially apt to be overlooked. This remark applies more particularly to the nose. In every case of tinnitus the septum and turbinate bones have to be carefully explored. In many instances it will furnish an explanation of the aural condition.

Class 4. Here we realise a source of tinnitus which has its direct origin rather in a muscle than in a nerve. Obviously, any abnormal action of the tensor tympani or stapedius, causing increase or diminution of pressure and alteration in the equilibration of the labyrinthine fluid may start a tinnitus. Remembering this, we must not omit to seek for the starting point of the mischief in some direct or reflected irritation in the facial or fifth nerve. It is not necessary in such cases that we should find any indication of an affection of the middle ear or the labyrinth. Thus the hearing may be but slightly affected, or on the other hand, the influence on the muscles may be caused by gradual changes in the mucous membrane of the tympanic cavity and the ossicular ligaments, with accompanying changes in the mobility, position, shape and consistency of the membrane. If these latter are present they will be visible with the speculum.

Under Class 5 we find the commonest causes of tinnitus, both with and without deafness. Both in this and in the last group we may have, in the tympanic membrane in its displacement and obliteration of its segments, rigidity and immobility, or in varying degrees of collapse, the consequences of chronic catarrhal attacks, evidence of gross changes in the middle ear, which are associated with ankylosis of the ossicles and fixation of

the stapes. The patient will often complain of inability to join in general conversation in society, may hear better in a railway train or omnibus (*Paracusis Willisii*) and cannot synchronously distinguish two distinct tones, as for instance, the ticking of two clocks in the same room. On watching the membrane when Valsalva's method is practised, it may not in the least, or but very slightly, yield on inflation. The cone of light is but little altered, or we may detect but the slightest movement of either pocket with Siegle's speculum. On the other hand the membrane may appear thinner than normal, the malleus may be altogether displaced, so as to give the appearance of one large pocket which is blown bladder-like out on inflation. But it by no means follows that such pathological signs must be present, even though there be considerable impediment in the Eustachian tube from imprisoned secretion, collapsed walls, stenosis, or obstruction from other cause. Slight deviation from the normal position and translucency of the membrane may be detected, but it is only on listening with the otoscope to the inflation of the tympanum, and by careful observation of the membrane through Siegle's speculum, that we are enabled to discover obstruction or collapse of the Eustachian tube. Examination of the nose and throat may give the clue to the interference with the tympanic ventilation. In the nose, spurs or deviation of the septum, enlarged turbinates, hypertrophic mucous membrane, polypus, rhinolith (both the latter rarely); in the throat relaxed and feeble palatal muscles, congestion of the palato-pharyngeal mucous membrane, generally with elongated uvula, tonsillar hypertrophy, adenoid growths, are among the more frequently occurring and accompanying conditions which explain the Eustachian interferences, and account for the altered relations of the

air in the tympanum to the blood in its vessels, as well as the pathological conditions of the vessels themselves.

In Class 6 I have included those more serious middle ear complications which follow upon disease of the arterial tissues—local apoplexies, extravasations of blood, lymph exudations, congestion of the venous sinuses, arising from pressure or from cardiac diseases.

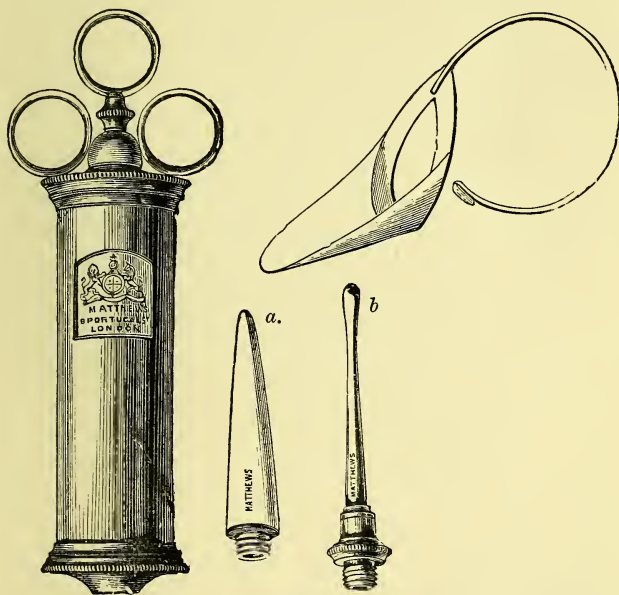
To it also we refer those noises arising from obstructed pulmonic circulation and deficient oxygenation. There are those more serious inflammations of the mastoid and petrous portions of the temporal bone, which lead to both exudations and suppuration. The recognition of such states is not generally difficult. A careful examination of the tympanum with the speculum, showing possibly intra-tympanic growths, granulations, or polypi, and the presence of a fetid discharge will at once arouse suspicion of a deeper-seated cause for the pain, giddiness, or tinnitus, than that recognisable with the speculum.

Pain, tenderness and fulness over the mastoid, with projection of the auricle, will generally be present when there is threatening of mastoid abscess; pain more violent and diffused over the head, possibly pupillary changes, optic neuritis, tendency to delirium and secondary lung complications, if the disease has extended deeper and has involved the petrous portion of the temporal bone, or has possibly implicated the lateral sinus.

The causes of tinnitus, included in Class 7, are easily discovered, and hence the greater need for their being the first sought for and not over-looked. It may not be amiss to say a few words on each of these outer ear sources of tinnitus. Inflammation and abscess are easily recognised by the local symptoms of pain, severe heat, throbbing, swelling, and occlusion of the meatus,

tinnitus and deafness. Such inflammation and abscess may lead to inflammation of the membrana tympani and perforation of it. These acute perforations are frequently attended by severe pain and loud tinnitus. They may be seen, if viewed through the speculum, to pulsate. Re-

FIG. 15.



Aural Syringe and Spout. This will be found a useful and powerful syringe.

current furunculi occur frequently in the meatus, associated with otomycosis. Such inflammatory conditions frequently have a miasmatic origin.*

* I have elsewhere discussed fully the bacteriological relations of outer and middle ear inflammations.--*Lancet*, July 27th, August 3rd, 1889.

The rains of spring, low lying and damp localities, and all depressing influences tend to favour the formation of such furuncles, and auto-inoculation to cause their recurrence.

It has to be urgently insisted on that all such abscesses and furuncles demand as careful attention in their departure as during their more acute and active stages. Dead debris of purulent collections, epithelium, or cerumen, are apt to be left behind and cause chronic irritation in the ear passage, and may possibly lead to the occurrence of aspergillus or perforation of the membrane. This caution is the more necessary if the attack is attended by middle ear inflammation and perforation of the drum-head. A persistent tinnitus may be the consequence, which a little local attention will remove. Take such a case as the following :—A lady, aged sixty, was brought to me suffering from these symptoms. A most distressing tinnitus, “like a steam engine,” was heard almost entirely in the left ear, through which she complained, “shooting pains occasionally darted.” There had been deafness of the right ear since childhood. She suffered occasionally from attacks of giddiness. The acoumeter was heard at less than two inches, and the watch, not on contact. The meatus contained a plug of cerumen, the removal of which caused but a little difference in the hearing. On exposure of the membrane, an old perforation was seen in Schrapnell’s membrane, and there were evidences (with Siegle’s speculum) of long standing contractions and adhesions. In the left ear the hearing was better than in the right, the watch being heard well on contact. In the meatus was a plug of cerumen and dead cuticle which was very difficult to remove. This was pressed down on the drum-head, the walls of the passage being in an inflamed and irritable condition.

When the meatus was cleared and the tympanum inflated, she heard the watch at four inches well, and the acoumeter at fifteen feet. Her tinnitus was gone. I merely mention the case to shew that it is possible to overlook such simple causes of deafness, giddiness, and tinnitus.

Eczema of the meatus, especially of the gouty type, which is started by irritation of its walls, may be the sole cause of the tinnitus, and is frequently incurred by the entanglement of the desquamated particles of cuticle in cerumen and discharge which clog the lumen of the meatus and impinge on the membrane. Both exostosis and hyperostosis may set up a tinnitus by the irritation they cause. But it is rare to find these as a sole cause of tinnitus, and they are frequently present without it.

More often we can trace the occurrence of the noise to associated middle ear catarrhal conditions, a gouty diathesis or some Eustachian obstruction. In gouty patients there is at times a distinct neurotic exaggeration of symptoms which includes a dwelling on, and morbid apprehension of any tinnitus that may be present. Over indulgence in alcoholic drink, and, possibly, excess of tobacco smoking, contribute to increase the loudness and intensification of such noises. It must suffice to refer to othœmatoma* (insane ear) as a cause of tinnitus, inasmuch as its etiology and pathology demand separate treatment. The nature of this affection I have fully discussed and illustrated elsewhere, both in the *Atlas of Diseases of the Tympanum* and the *Practitioner's Hand Book of Diseases of the Ear*.

Of the therapeutical sources of tinnitus, the only one I propose to delay over is quinine. That a temporary

* A sanguineous effusion of blood from the perichondrium investing the cartilage of this auricle.

tinnitus, deafness, and giddiness follows on the prolonged use of large doses of quinine is well known. At times this amounts to that condition known as quinine intoxication. I knew of one instance in which an officer, appearing on parade shortly after some large doses of quinine, so nearly approached the condition of a drunken man that he was placed under arrest on a charge of inebriety.* I have elsewhere instanced the case of a man on whom I was making some experiments in 1868 in estimating the quantity of the alkaloid quinia excreted by the kidneys. In this case a dose of thirty grains of quinia was followed by partial deafness and a tinnitus which never quite disappeared. Burnet insists, and with this view I quite agree, that in most of the cases in which any permanent effects have been noticed as following the use of quinine there have been other causes present quite sufficient to account for the tinnitus or deafness independent of the quinine. Still the fact that quinine can produce aural disturbances of function, and that many of those, who have taken quinine in large quantities, complain of tinnitus and deafness, added to the possibility of its producing a congestive state of the vessels of the labyrinth, independently of its irritating effect on the hearing centre, is sufficient to point to quinine as a probable and predisposing cause of tinnitus.

* *Practitioner's Hand Book of Diseases of the Ear and Naso-Pharynx.*

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CHAPTER IV.

PROGNOSIS.

It has to be confessed that, in the present state of our knowledge, it is difficult, in defining the grounds on which we arrive at a prognosis in cases of tinnitus aurium, to follow the lines of the classification that have been suggested. Yet that attempt at a differentiation of the causes of tinnitus may be of use in confining the proposed therapeutical steps to certain clinical and pathological conditions which may justify us in hoping for relief, if not cure, following on their application.

- (1.) We may, in the first place, fairly exclude from the category of curable cases those noises which attend on cerebral tumours, lesions, apoplexies, and degenerations which are secondary to the occurrence of thrombi. It is, however, conceivable that certain cerebral effusions may yield to time and such special remedies, as, for instance, iodide of potassium and mercury.
- (2.) Atrophy, sclerosis and traumatic lesions of the auditory nerves.
- (3.) Rigidity of the membrane of the round opening, and fixation of the stapes against the oval opening.
- (4.) Extravasations in the labyrinth.
- (5.) Organised effusions in the labyrinth.
- (6.) Traumatism of the labyrinth.

- (7.) Rheumatic, gouty and syphilitic degeneration of the walls and vessels of the labyrinth.
- (8.) Organic changes in the periphery of the auditory nerve.
- (9.) Certain chronic and irremediable conditions of the intra-tympanic muscles, leading to atrophy, rigidity, or spastic contractions.
- (10.) Many cases of chronic catarrhal inflammation, with corresponding and evident changes in the tympanum, in which a considerable degree of deafness attends on the tinnitus, and in which there is a history of progressive deafness extending over a considerable time, with possibly hereditary deafness in the patient's family; permanent closure, or occlusion of the Eustachian tube, may be included under this head.
- (11.) Many cases of chronic Ménière's affection (true labyrinthine vertigo) in which, after the more acute symptoms have subsided, there still persists deafness, occasional attacks of migraine and tinnitus.
- (12.) Tinnitus consequent upon aneurysmal conditions of the auditory arteries or atheromatous changes in their tissues.
- (13.) Exudations and tumours of the mastoid cells, say of a syphilitic and gummatous nature, or disease of the petrous portion of the temporal bone consequent upon chronic suppurative catarrh of the tympanum.
- (14.) Distinct aural hallucinations attendant upon or following gross changes in the middle ear and labyrinth.

Turning now to those cases in which we may hope for amelioration, if not complete cure of the tinnitus, we may thus classify them :—

- (1.) Tinnitus arising out of any reflected local or systemic irritations of the auditory centre or auditory nerve, which are due to deficient morbid blood supply, or vaso-motor disturbances in the auditory areas.
- (2.) Tinnitus arising out of simple primary hyperæmia of the labyrinth or a hyperæmia which is secondary to certain fevers as intermittent fever, puerperal sepsis, so-called "cerebral" fever, and the continued fevers.
- (3.) Tinnitus consequent upon temporary alterations of the labyrinthine equilibration, whether due to altered conditions of tension of the fenestræ or increase or diminution of blood pressure, and frequently associated with cardiac functional disorders; simple hyperæsthesia acoustica.
- (4.) Tinnitus which has its origin in rheumatic, gouty and syphilitic conditions, whether in the labyrinth or middle ear; in the uræmia of pregnancy or Bright's disease.
- (5.) Tinnitus due to abnormal states of the intratympanic muscles, as enervation, spasms, altered muscular tension (from defective middle ear ventilation and equilibration), producing conditions and positions of the membrana tympani and accompanying deviations in the normal relations of the ossicles, which have their consequent effects on the labyrinth through the fenestræ.
- (6.) Tinnitus arising out of enervation of the tubal muscles of the Eustachian tube, collapse and closure of the walls of the tubes, temporary obstruction of the tubes from catarrhal conditions of the mucous membrane, or accumulation of mucus in the tube.

- (7.) Tinnitus arising from irritations in the external ear.
- (8.) Tinnitus arising from therapeutical causes.
- (9.) Aural hallucinations which occur independently of any acoustic or cerebral trouble and which may be associated with visceral or pelvic neuroses. Such hallucinations, if they become insane hallucinations, disappear with the mental alienation.

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CHAPTER V.

TREATMENT.

HAVING thus attempted briefly to indicate the grounds, clinical and pathological, on which we may hope to come to a decision as to the prospects of relief of the noises complained of in any individual case, I may summarise the therapeutical means at our disposal for treating such subjective sounds. We may, for practical purposes, consider the therapeutics of tinnitus under two principal heads:—

- (1.) Therapeutical measures directed to correct any local defects in the organ of hearing itself.
- (2.) Therapeutical measures adopted for the relief of such systemic derangements as may cause tinnitus.

In such a summary of treatment as that I propose I do not enter into details of operative steps. This would not be possible in a work of this magnitude.* But I hope sufficiently to indicate the principles on which lines of treatment are determined, so as to enable the practitioner to apply them in any case coming under his care.

Under the first head we include:—

- (a.) Attention to the entire naso-pharyngeal tract,

* It is more fully done in the *Practitioner's Hand Book of Diseases of the Ear and Naso-Pharynx*. Fourth Edition (in the press).

including the state of the nares, the nasopharynx, the soft palate and palatal muscles, the pharynx including the tonsils.

- (b.) Attention to the external, middle and internal ear.

Under the second head we embrace :—

- (a.) A consideration of the temperament and diathesis of the patient, the other evidences of hereditary disease, occupations, habits, vices, influences of climate and residence.
- (b.) Attention to those evidences of visceral disorders which are shewn in maldigestion, bilious states, flatulent distension ; symptoms of functional and organic cardiac affection.
- (c.) Enquiry into the general health of the nervous system may elicit proof of organic or reflex nerve irritations and neuroses. The health of the cranial nerves particularly should be tested. Headaches, insomnia, ocular migraine and vertigo, aberrations in smell or taste, require investigation. Early signs of mental alienation and any hallucination must not be overlooked.

It cannot be disputed that every form of nasal obstruction is repeatedly found, and tinnitus has not followed as a consequence. The same observation applies to deafness. I have found the nasal passage quite occluded from hypertrophic rhinitis, deviation of the septum, enchondromata, polypus, posterior turbinate hypertrophy and adenoid growths, yet neither tinnitus, deafness, nor vertigo have been present. Nor can this be explained by the fact that any particular area or special set of nerve filaments have escaped the chronic catarrhal process. Deafness alone is more frequently found at the side of the occlusion if only one nasal cavity be involved. But the number of times I have been con-

sulted for rhinitis and difficulty of breathing when there has been no aural complication of any kind, though the occlusion of the nasal passage has been considerable, has convinced me that it is not so much to the mere fact of occlusion we must look for an explanation of the aural symptoms, as to the associated nasopharyngeal and tubal condition which frequently follow on rhinitis and obstructed nasal respiration.

Nasal vertigo is frequently found without aural symptoms being present. This is due to reflected irritation, and not to obstruction. If tinnitus and vertigo, or tinnitus alone, be present, we may be pretty certain that there is either an associated disturbance of equilibration of the labyrinthine fluid, which disturbance may be secondary to an interference with normal ventilation of the tympanum, or they are caused by a reflected irritation which produces vaso-motor changes in the correlated areas presided over by the nerves, communicating with those suffering in the irritated or congested nasal membrane. Referring to the anatomical connections already referred to, we can have no difficulty in realising how such irritations starting in the nasal areas may cause reflex aural tinnitus or vertigo through the relation of the ampullar and vestibular nerves to the cerebellum. Besides, as I have elsewhere said, there may be in certain individuals special inherited susceptibilities or abnormal excitability of the hearing and vertiginous centres (McBride), to account for the slight disturbance of physiological balance, which may account for these symptoms in some persons and not in others.

What then are the nasal affections which most frequently demand treatment for the cure or relief of tinnitus?

They are in my experience :—

(1.) Deviation of the septum nasi ;

(2.) Acute and chronic rhinitis ;

(3.) Hypertrophic rhinitis.

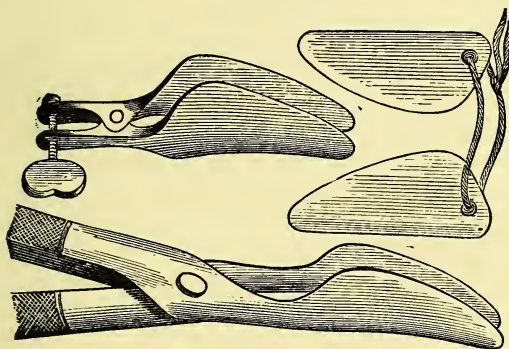
Tinnitus may occur coincidently with such affections as hypertrophy of the posterior extremities of the superior turbinate bone, polypus, adenoid growths, post-nasal catarrh. If so, we must remove the two first mentioned of these causes by operative interference, and the latter by suitable treatment, before we can determine the correlation existing between these conditions and the tinnitus. But I do not think that there is any doubt that the three affections specified by me are those generally demanding active attention both for the deafness and tinnitus.

Deviation of the Septum Nasi and Exostoses.

Some deviation of the septum exists in a large proportion of people, it is more frequently found towards the left side and varies considerably in character and extent. The projection may be partial or general, the septum projecting in an angular form and generally curving outwards so as to touch the turbinate bones and occlude the nasal passage. In some cases the septum is irregularly curved into hollows and projections which more or less obstruct both nares. Associated hypertrophy of the turbinate bones is a common condition. If this is the case, and especially if there be accompanying catarrhal rhinitis, there is nasal pronunciation and obstructed nasal breathing. Deafness, tinnitus and anosmia, are not unusual consequences of the nasal obstruction. Such deviations vary in degree, from simple deflection of the cartilage to associated displacement of the vomer and ethmoidal plate, and in

character from slight lateral deviations to great irregularity with curves and convexities of the septum, the summits of which are eroded from contact with the turbinated body. Or the septum may present a sharp angular deflection to the one side, occluding the nasal passage of that side, and obstructing the view or the passage of a bougie. Or it may have at one side a plicated appearance from the presence of deep sulci which exist between the cartilaginous eminences. Any such conditions, existing side by side with a tinnitus or deafness, demand active treatment. These interferences include forcible replacement of the deflected septum with a septum forceps (Fig. 16) as that of Mr. William

FIG. 16.

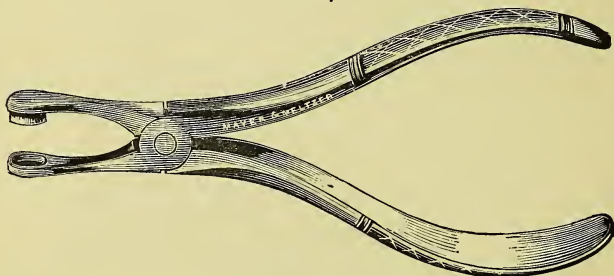


Mr. Adams' Septum Forceps and Clamp.

Adams, and the subsequent use of his septum clamp (Fig. 16) and nasal plugs. Of such forcible rectification, even to the point of fracture, with subsequent care of the re-adjusted septum, I can, from numerous

cases in my own practice, speak most favourably.* At times it is absolutely necessary to cut an aperture in the septum by means of a septum drill or punch (Fig. 17) such as that shewn in the figure. In any of these operations much of its success depends on the after treatment and the dressing of the artificial aperture, so as to preserve its potency, and maintain the septum in its proper position.

FIG. 17.



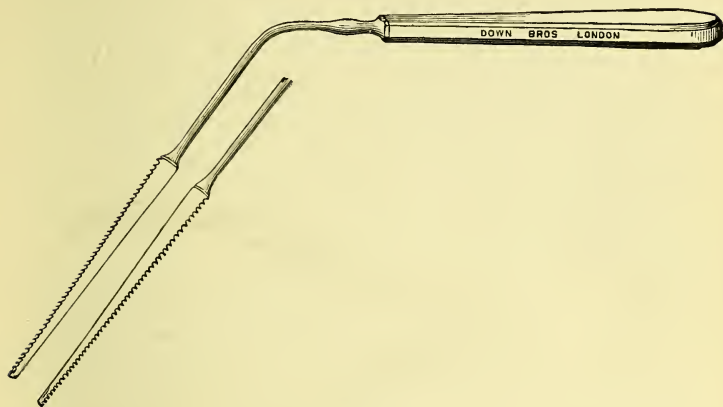
Mr. Adams' Septum Punch.

Exostoses, if they obstruct the nasal cavity, must be removed by a fine nasal saw (Fig. 18). The hardness of the growth, its situation generally springing with a broad base from the septum, and its colour, paler than the surrounding membrane, are sufficiently characteristic signs to distinguish it by. It is well to reflect the periosteum from off the base of the growth before the saw is applied. Should the obstruction to respiration depend on osseous enlargement, and the

* Dr. Garrigou Désarènes (Paris) has devised a useful septum clamp which consists of two septal plates on a sliding shaft. They are approximated by means of a thumb screw, and considerable force can thus be exerted on the septum. These plates are left in position for a few minutes.

turbinate bones be involved in the general hypertrophic condition, then the bone itself may require in whole or

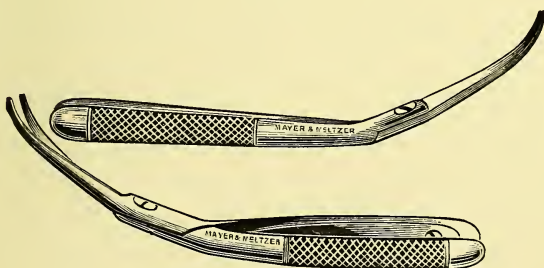
FIG. 18.



Nasal Saw.

part to be removed. But in all cases, I think that such removal of the bone should only be decided upon when

FIG. 19.



Author's Nasal Shears.

the other means for reduction of the hypertrophied structures have failed, or where it is obvious from the first that the morbid encroachment on the nasal cavity is of

an osseous nature. The turbinate bones discharge most important physiological functions in the respiration process, apart from other uses in the sense of smell and the arrest of atmospheric germs. They are not to be regarded as superfluous appendages, created specially for the benefit of the nasal specialist. Should the surgeon decide on the removal of a turbinate bone or any overgrowth from it, this is easily effected by Woakes' nasal and catch forceps, which catch the bone and act as a guide for his plough, or we may use a shears (Fig. 19).^{*} Such operations may be done under ether, chloroform, or after a thorough application of cocaine.

Acute and Chronic Rhinitis.

In any case of tinnitus, with a history of recurrent rhinitis, such acute attacks have to be carefully guarded against by avoidance of exposure to draught and sudden changes of temperature, or chills when the body is heated. Patients must be cautioned that uniform clothing is most important, sudden changes being avoided. This applies especially to underclothing. The feet must be kept warm. Attention to this precaution is especially to be insisted on, habitually cold feet being often found in conjunction with tinnitus. Warm stockings and cork soles to the boots or shoes ought to be habitually worn. During the cold months of the year the sleeping apartment should be sufficiently warmed before it is used, so as to prevent the consequences of a sudden change in temperature on retiring from the usually warm sitting-room. In the case of women, especially, delay in change of toilet, standing about in cold bedrooms must be discountenanced. Care in railway travelling, at theatres, and in churches, is de-

^{*} Messrs. Mayer and Meltzer have recently made for me a very convenient modification of Woakes' shears, with new curves in the handle and blades.

manded for similar reasons. There can be no question that with some individuals there is a strong predisposition to attacks of rhinitis (I am not here referring to hay asthma). With such persons the slightest exposure to an exciting cause is sufficient to produce an attack. They are also more susceptible to any infectious influence, as sleeping with or kissing anyone who is at the time suffering from an attack. And with them also, irritating substances in the atmosphere may readily both excite and maintain the catarrhal state. Fog, smoke, dust, pungent vapours, are amongst the commoner sources of such irritation. Besides taking these prophylactic measures, which may enable predisposed persons who suffer from tinnitus to avoid catarrhal attacks, they should be forearmed against any consequences that may tend to produce middle ear complications.* They may cut short the acute stage by "nursing the cold in the head," by remaining indoors, and taking a powder of

Pulv. Doveri	...	...	...	grs. v.
„ Jacobi Ver	...	...	...	grs. iii.
„ Nitratis Potassæ	...	...	...	grs. x.

at night, and a saline aperient the following morning. This may be followed by a diaphoretic, such as

Spt. Æth. Nitrosi	...	...	...	ʒiv.
Liq. Am. Acet.	...	...	...	ʒii.
Tinct. Opii.	...	...	...	ʒi.
Syrupi. Simp.	...	...	...	ʒiv.
Aquam ad....	...	...	...	ʒiv.

A dessert spoonful in half a wineglass of water every two hours for the first few doses, and every fourth hour subsequently.

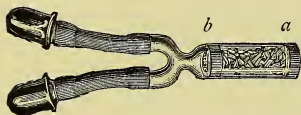
Or I have frequently given with good effect doses of $\frac{1}{16}$ th to $\frac{1}{8}$ th of a grain of muriate of pilocarpine, with

* See page 69, Catarrh of the middle ear.

a few drops of tincture of belladonna. The patient must remain in a warm room, well wrapped up, while diaphoresis is produced.

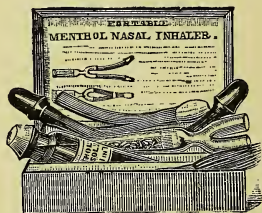
The infusion of jaborandi may be given for the same purpose. I cannot say that either phenacetin or anti-pyrin have much effect in my experience in aborting an attack, and I may say the same of quinine, the larger doses of which, for obvious reasons, I should avoid in cases of tinnitus. Of local measures, those which I have found most efficacious are, thorough greasing of the nostrils, on going into bed, with a carbolised and lanolated ointment of benzoated lard and glycerine, strong

FIG. 20.



For Nasal use.

FIG. 21.



Case containing Menthol, an Oral and Nasal Inhaler.

Nasal Pocket Menthol Inhaler of Author, to be had in small case with the menthol solution and an oral piece. (Burroughs and Wellcome). The menthol solution is dropped through the gauze covering (a) into the pine wood filling glass cylinder (b).

camphor inhalations, free steaming of the nostrils with hot water (at 150°), and carbolic acid (10 drops to the pint), menthol inhalations and applications, iodine inhalations, menthol snuff, bismuth and morphia insufflations, cocaine spray (1 per cent. in an alkaline solution of carbonate of soda and common salt, 10 grains of each to the ounce). The cocaine is, however, most efficaciously and safely, used by the surgeon himself, when the swollen membrane is swabbed with a four or five per cent.

solution. This may be done once or twice daily, unless any untoward symptoms arise from the cocaine. A solution of menthol is readily made by dissolving one part of menthol in seven of paraffin or olive oil, the

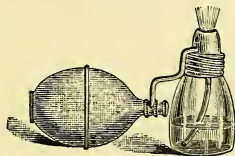
FIG. 22.



Post Nasal Ointment Atomiser (Burroughs and Wellcome).

former "Paroleine" being preferable, as it does not turn rancid in keeping. Paroleine, the fatty paraffin oil (Messrs. Burroughs and Wellcome), may with advantage be prescribed as a solvent for several of the vola-

FIG. 23.



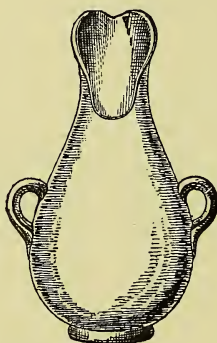
Nasal Ointment Atomiser (Burroughs and Wellcome).

tile oils used in nasal treatment—as for example pinol, eucalyptol, menthol, thymol. The proportions for these oils are: pinol, 1 in 9; thymol, 1 in 9; eucalyptol, 1 in 9; menthol, 1 in 7; also iodoform, 1 in 60; carbolic acid, 1 in 19; camphor, 1 in 4. The nasal ointment

atomiser, of the same firm, may be used to apply these oils in the form of a fine spray either to the nose or throat (Figs. 22 & 23). The neutral oil "adepsin" (Messrs. Corbyn, Stacey & Co.) is also a useful solvent of menthol. Menthol snuff is made according to this formula.

Camphor, I have often both used myself for the acute stage of catarrh, and advised it for others in this simple

FIG. 24.



Spenser-Thompson's Naso-oral Inhaler.

fashion. A little powdered camphor is placed on a metal spoon and heated over the fire. Some of the warm and pungent camphor is then taken and rubbed between the hands, which are formed into a cone so as to make a naso-oral inhaler, covering the nose and mouth, and the fumes are thus inhaled.

Or the camphor (with $\frac{3}{4}$ of simple tincture of benzoin to the pint) may be added to water at 150° - 180° , in a Spenser-Thompson's naso-oral jug (Fig. 24), the mouth of which fits over the patient's mouth and nose. It is the

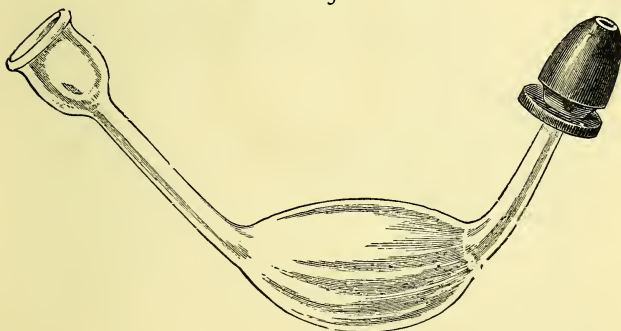
simplest and best inhaler *for this purpose* I know of. (The jug must be shaken occasionally, as the resinous tincture is apt to sink to the bottom.)

Dr. Ffolliott recommends, in the early stages of rhinitis (and it will be found of service), a quinine spray of six grains to the ounce of water, used occasionally to spray the nostrils with.

Dr. Watson Williams (*Medical Annual*, 1891) advises a wash of

Soda bicarb.,	Soda bibor.,	of each	3i.
Soda Salicyl. . . . .	...	...	gr. i.
Thymol . . . . .	...	...	gr. i.
Menthol . . . . .	...	...	gr. $\frac{1}{2}$
Glycerine . . . . .	...	...	3i.
Water . . . . .	...	...	3iii.

FIG. 25.



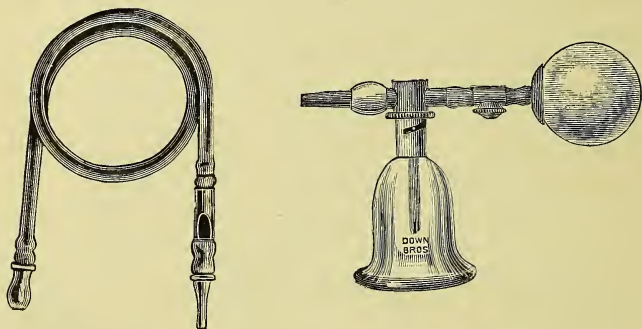
Dr. Woakes' Nasal Irrigator.

This, added to a quart of water, makes a useful wash. This wash has been prepared in the form of tabloids.

In the treatment of *chronic rhinitis* it will often happen that every remedy fails after a certain time to give relief. If there be much swelling of the mucous membrane and the coryzal discharge be profuse, I believe the

best treatment is a light application of the galvano-cautery point over the congested areas of the turbinate bodies. I prefer it much to the use of any acid. Before, however, we resort to this remedy, we may try various dry insufflations, vapour atomisers, irrigations, douches, ointments and soluble bougies.*

FIG. 26.



Auto-insufflator.

Kabierske's Insufflator.



Nasal and Laryngeal Mounts to fix on the Insufflator.

Of the dry insufflations I prefer those of—
 Bismuth (carbonate or subnitrate),
 Bicarbonate of soda,
 Boric acid,
 Tannic acid.

* Mr. Spicer has devised useful hollow cylindrical bougies of bismuth, cocaine, iodoform, &c., which are made by Messrs. Corbyn, Stacey and Co.; those of iodoform have the disadvantage of liberating its unpleasant odour; this might well be concealed by eucalyptol or pinol.

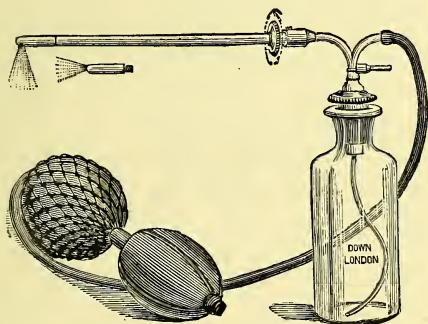
Iodoform (deodorised by coffee or vanillin or coumarin) or iodol. To any such insufflation $\frac{1}{12}$ th of a grain of acetate of morphia may be added, as, for example, the following combination :—*

Bismuth Subnitrate	...	...	grs. v.
Acid Boric Subtil	...	...	grs. ii.
Pulv. Gum Acacia	...	...	ā ā grs. iii.

To be placed in the auto-insufflator, and blown into the nostrils three times daily.

As vapour atomisers, the most efficient are alkalis solutions of bicarbonate and biborate of soda, with chloride of sodium, to which we may add 2 per cent. of Listerine (a useful compound of the essential oils of gaultheria, eucalyptus, thyme, and benzo-boracic acid, &c.).

FIG. 27.



Reversible Nasal Spray.

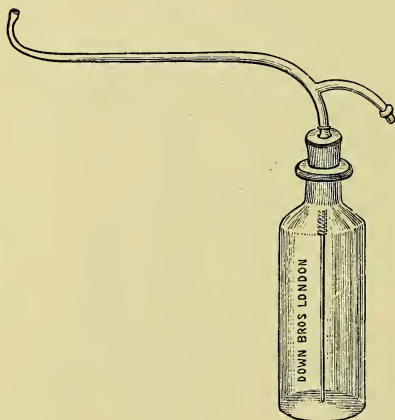
As astringents, solutions of alum, sulpho-carbolate of zinc, tannic acid, are most useful. To such solutions we may add carbolic acid (min. v.— ʒ viii.). Nitrate of silver solution (grs. ii. ad. ʒ i.) sprayed for a few seconds into the nostrils, twice daily, is often efficacious in re-

* The medicated cigarettes made at my suggestion by Messrs. Corbyn contain either iodoform or iodo-salicylic acid. See Appendix.

ducing congestion and discharge, or a spray of chloride of zinc (grs. ii. ad. ʒi.). Borate of soda and sulpho carbolate of zinc may be used, dissolved in "Hazeline," as a nasal spray.

Of applications, I think the solution of menthol is one of the best. This may be applied to the mucous membrane with a camel's hair pencil a few times daily. I have sometimes found a weak chromic acid solution

Fig. 28.



Post Nasal Spray.

(grs. v. ad. ʒi.) of service. The liquid extract of hydrastis in combination with iodine and carbolic acid in glycerine is another valuable application in old cases of rhinitis.

Ext. Hydrastis Liq.	...	...	min. xxx.
Acid Carbolic	...	...	min. v.
Tinct. Iodi.	...	...	min. xxx.
Glycerine	...	...	ad. ʒi. M.

To apply with the nasal cotton holder daily.

For the soft yielding pouches of mucous membrane that are found projecting from the turbinate bones in cases of chronic rhinitis, and which disappear under the application of a 5 per cent. solution of cocaine, I believe a light application of the galvano-cautery to be the most efficient treatment.

Chronic Hypertrophic Rhinitis.

I include under this head, turbinate hypertrophy—both anterior and posterior—thickening of the mucous membrane of the septum nasi, and possibly stenosis of the nasal passage. Such a condition is generally attended by other symptoms than those of tinnitus and deafness; as, for example, oral breathing, nasal speech, excessive secretion from the nasal mucous membrane and the pharyngeal glands or laryngeal irritation. It would not be possible here to attempt more than a summary of the various plans of treatment.* First, we must endeavour to reduce the general tendency to congestion and thickening and to prevent the arrest and detention of morbid secretions in the nasal passages or in the Eustachian tubes. Secondly, we have to secure a free passage for the atmospheric or respired air through the nares in respiration.

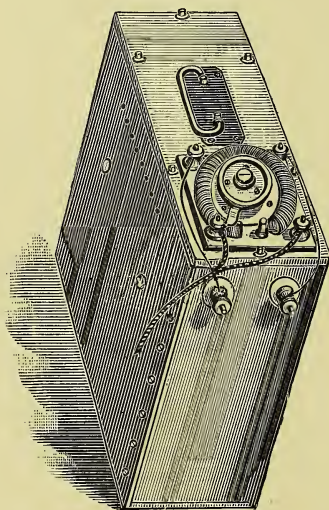
Lastly, we have to prevent the extension of the morbid process to the naso-pharynx and pharynx, and prevent the pressure from posterior growths of the turbinate bones on the Eustachian tube, which is certain to follow if this posterior turbinate encroachment is permitted to advance unchecked.

With such indications in view, we resort in the first

* For fuller information on the subject of treatment see the treatises on this subject recommended in the preface.

instance to such alkaline, astringent and antiseptic applications as those recommended in chronic rhinitis. The second indication is fulfilled by such operative measures as the application of the galvano-cautery (Fig. 29) to the hypertrophic portions of membrane. We

FIG. 29.

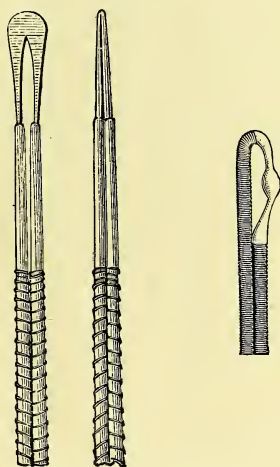


Portable Accumulator Battery for Cautery (Coxeter).

may employ the cautery either as knife or snare. The former is the most serviceable for soft enlargements, the latter for those hard, tumour-like masses that project into the passage and impinge against the membrane. Both of these appliances can be used with safety through the nasal speculum, the parts being well illuminated by the reflectors. Care has to be taken not to burn the membrane of the septum or the margin of

the nostril, which may be protected by a septum shield. The hypertrophied or congested areas are cauterised with the knife, or the sharp platinum blade is carried into the tumefaction to the necessary depth (Fig. 30). If the space between the turbinate bones, or between these and the septum, is much constricted, care must be taken that no adhesions form during the few days after

FIG. 30.



Cautery Platinum Points for Nose.

the cautery is applied. This can be prevented by the passage of a soft, well-oiled bougie (Fig. 31) or the insertion of a fine strip of oiled muslin between the opposed surfaces. The knife should be used at a red heat. I have never had any unpleasant consequences after the galvano-cautery, which I believe to be the safest and best of all the therapeutic means at our disposal for treating hypertrophic rhinitis. In the case of hyper-

trophies of the posterior extremities of the turbinate bones, these having been diagnosed by the finger or rhinoscopic mirror, removal of the growths must be effected by either the cold snare or the galvano cautery.

Such operations require extreme care and delicacy of manipulation, and are best carried out by those familiar with such manipulations.

In cases of doubt as to the nature or consistency of these enlargements, cocaine is a great help in diagnosis; the soft, vascular and venous projections generally disappearing under the influences of a 5 per cent. cocaine solution, whereas the hard varieties remain unaffected. For softer growths, to which we cannot apply the galvano-cautery, chromic acid has occasionally given me very good results. This may be applied in the form of crystal, as some recommend, or in solution of one drachm of the acid to the ounce of water and glycerine, taking these precautions: A nasal cotton holder (Fig. 35A), curved as required, has a small portion of absorbent wool rolled

firmly round its tip; this is saturated with the chromic acid solution and carried to the swelling, against which it is then applied, or a long flexible probe may have its point heated in a spirit lamp and then touched with crystals of the acid; sufficient adheres for a few applications. Sajous speaks highly of nitric acid, but I have no experience of its effects. Obviously it requires the greatest care in its application.

FIG. 31.



Soft grooved Nasal
Bougie.
Modification by Mr.
Stoker.

Glacial acetic acid applied with Bosworth's probe (Fig. 32) is also a most valuable application. Both of these agents must be re-applied after some days' interval, until an evident effect is produced on the hypertrophic projection.

FIG. 32.



Bosworth's Probe.

For the removal of other growths in the nares that cause obstruction, the reader must refer to more special treatises on the nose. I have briefly referred to those which in my experience are more commonly found with tinnitus. The etiology and treatment of adenoid tumours growing in the naso-pharynx are fully discussed in my "*Practitioner's Handbook of Diseases of the Ear and Naso-Pharynx*," and in all aural treatises. Rarely have I

FIG. 33.



Author's portable flat and screw end Nasal Probe.*

found them to be a cause of tinnitus. I may make the same remark of polypus. Of therapeutic measures other than operative, I believe we can do much in those cases of tinnitus in which there is chronic and hypertrophic rhinitis by sending patients to some of the Continental or home spas, which are calculated to reduce

* This combines the advantages of Bosworth's probe and one with a blunt end. It is both diagnostic and therapeutic. It can be carried in the pocket case.

the congestion and hypertrophy. Undoubtedly, two of the most efficacious of these are Aix-les-Bain and Cauterets. With the use of both of these waters, locally and generally, I have known cases that resisted prolonged treatment at home, cured. The waters of Ems and Wiesbaden are also beneficial. The Kochbrunnen salt of the latter may be dissolved in warm water, a teaspoonful to the half-pint, and employed in the form of local spray, or as a drink (a tumblerful of this strength two or three times in the day). The waters of Bath may be tried in the same manner. There are many other waters which may be availed of, but I mention these as I have had the best results from their exhibition. If sulphur waters are indicated, those of Harrogate, Strathpether, or Aachen are not to be surpassed. If an arsenical course is desired, Bourboule or Royat are the best, and if one of iodine and bromine, Woodhall Spa, in Lincolnshire, is the most convenient, or Kreuznach, in North Germany.

NOTE.—Suchanek, of Zurich, recommends the soziodolates of potassium, sodium, zinc and mercury in nasal affections. Fritsche and Seifert use the soziodolate in the form of powder, mixed with talc (1 to 1 or 2), as a nasal insufflation in chronic rhinitis with profuse discharge. Soziodolate of zinc, mixed with talc in the proportion of 1 to from 12.5 to 7.5, he regards as “an active stimulant of the nasal glands, and hence proves of great service in chronic hypertrophic rhinitis associated with scanty secretion and swelling of the lower turbinated bodies.”

“Holste, of Gottingen, has used aluminium acetico-tartaricum in catarrhal disorders, and found it beneficial, although exceedingly irritating when abrasions were present. Mr. Graham, of Chattanooga, employs with advantage the hydragogue effect of glycerin to reduce nasal hypertrophies. The cavity having been thoroughly cleansed, he applies a tampon soaked in a solution of glycerin, 1 part to 4 parts of water, leaving this *in situ* from one to four hours. He gradually increases the strength of the solution until equal parts of water and glycerin are used.” (*Annual of Universal Medical Sciences*, 1890.)

Attention to the External Ear.

In examining the meatus of a patient suffering from tinnitus, we look carefully for any particle of a foreign

substance that may, by irritation or pressure, cause it. The most frequent source of tinnitus in the external ear passage is cerumen. Along with it may be a collection of epidermis and the products of effusion or suppuration. Efficient syringing will remove both. Sometimes it is necessary to assist the syringe with the lever-ring, or crocodile forceps, in detaching adherent casts or portions of tenacious skin (Fig. 34). The same forceps may be used to seize any fine foreign substance that impinges on the membrane. The aural probe of the author may be employed to thoroughly cleanse the walls of the meatus if there be any sticky discharge or portions of epidermis, which have not come away with the syringe (Fig. 35). I find under these circumstances the following application admirable for cleansing the passage :—

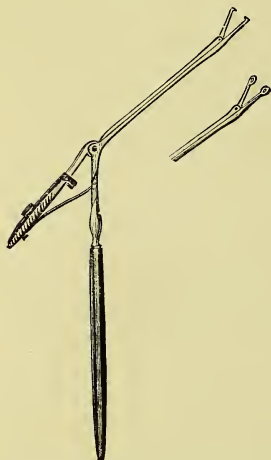
R _x Acid Boric	...	...	...	grs. xxx.
Sol Hydronaphthol	...	...	...	min. xx.
Alcohol Absolute	...	...	...	ʒii.
Sol Iodoform in Eucalyptol	ʒii.	(grs. 10 in	ʒii.)	
Glycerine	...	...	...	ʒii.

To be applied with the aural probe (or cotton wool holder). One of the author's aural vaporols (Burroughs and Wellcome) may be crushed and worn in the meatus at night (Fig. 36), if there is any persistent or foul accumulation in the passage. They contain either iodine or a eucalyptol solution of iodoform. The eucalyptol disguises the odour of the latter.

The combination, boric acid ʒss., carbolic acid ʒss., alcohol absolute ʒii., glycerine ʒii., will also be found efficacious for cleansing purposes, applied in the same manner. In all cases in which there is much difficulty in removing the adherent particles of epidermis, it is well to order a warm alkaline and antiseptic lotion to be used a few times daily, as, for instance, zinci sulpho-

carb. ʒi., soda bicarb. ʒii., soda bibor. ʒii., acid boric ʒi., glycerine ʒiv.—ʒii. in ʒiv. of warm water to

FIG. 34.

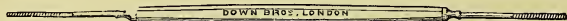


Crocodile Lever Forceps.

be used to douche the ear passage with a few times daily. The same treatment may be adopted for adherent eczematous collections. I have found the above-mentioned solutions very efficient for mopping the canal in these troublesome cases. An application, with the absorbent wool holder, of nitrate of silver solution (grs. v. ad ʒi.) may be made daily until the congestion and thickening are reduced. Such

astringent applications, if persisted in, will generally enlarge the lumen of the auditory canal if it be contracted from chronic in-

FIG. 35.



Aural Probe of Author.

FIG. 35A.



Aural Probe, armed at both ends with wool.

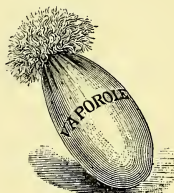
flammation, and blocking up with irritative secretions. It is seldom necessary to use any mechanical dilator, such as laminaria or sponge, which some recommend.

Before any applications are made, the entire passage should first be thoroughly dried with the wool holder. The patient should be taught to cleanse and dry the outer ear passage with the probe, and apply any prescribed solution to the affected portion. Circumscribed and diffuse inflammation of the external ear are frequently attended by subjective noises. So is the occurrence of furuncle. The miasmatic and infectious origin of such inflammations is a point which should never be overlooked in their treatment.

FIG. 36.



Aural Vaporole.



Nasal Vaporole.

The tendency of auto-infection in otomycosis, the relation of aural fungi to imprisoned discharge, the danger of neglecting the healing stages of abscess, the necessity for cleanliness and disinfection in the use of aural appliances—these and many other matters bearing on the bacterial relations of outer- and middle-ear inflammation have a most important influence on the treatment. The broad lines of treatment in all inflammations of the external ear are as follows:—In the early stages, efforts to subdue pain and control inflammation; early and free incision when there is evidence of suppuration; great subsequent care in preventing recurrence of the attack, and cautious watching of the outer and middle

ear during recovery. These principles are best carried out by avoidance of poultices, the use of warm anodyne and alkaline fomentations and douches, the application of Leiter's aural irrigator to the external ear, scarification of the swollen membrane, the local use of cocaine, both in the form of aural tampon and in the gelatine "aural ovoids"* of Gruber.

Instillations of warm alkaline and antiseptic preparations (carbonate of soda and perchloride of mercury) or the alcoholic solution of the latter drug (1 in 1,500—2,000 of alcohol) may favour resolution. The subcutaneous injection of the inflammatory swelling with carbolic acid (2—5 drops of a 2 per cent. solution) was strongly advocated by Weber Liel. When suppuration occurs, the pus must be evacuated by an incision, and the greatest care should be taken to prevent the accumulation of pus, and the imprisonment of discharge in the inner portion of the canal. Löwenberg's plan of applying to the wound an alcoholic solution of boric acid immediately after opening an aural furuncle, or Berzold's method of insufflation with the fine boric acid powder, are both to be recommended for preventing recurrence. This can be best prevented by daily attention to the ear-passage, and the use of suitable astringent and antiseptic treatment, calculated to arrest the inflammation, and to check those fermentative and septic consequences so prone to follow it.

Both *hyperostosis* and *exostosis* of the meatus are occasionally, but rarely, present with tinnitus. I have never met a case in which I could say that the exostosis alone was the sole cause of the subjective noise. There have been always present co-existent causes, either in

* These ovoids may be had of Bullock & Co., Hanover Street.

the meatus or middle ear, and frequently evidences of such constitutional sources of the tinnitus as gout or alcoholic excess. Nor is exostosis of the external ear-passage so common a complication or cause of deafness. In two thousand individual patients, carefully tabulated by me, I found exostosis present only in eighteen cases. It is true that in the majority of the cases of exostosis I have seen, tinnitus has been present sooner or later, but the noise was much more likely to be caused by the associated conditions, while I have frequently seen exostosis without tinnitus; and it may be noticed that of the 160 cases of noises in the ears classified by me, exostosis was only present in seven of the entire number. For the differentiation of hyperostosis from exostosis on the grounds laid down so fully by Tröltzsch and Hinton, the reader may refer to the "Handbook." Here I shall only repeat what I say there in regard to the treatment of these growths:—"It is wonderful how much we can effect without resorting to the more formidable steps of drilling or gouging the exostosis. I have had several patients with exostosis, in which a mere chink existed, now hearing well, and with a permanent opening, in whom no treatment was adopted save the sustained dilatation of the contracted canal (with Bonnafont's dilators and laminaria), and the application with the aural probe—most useful for this object—of such astringents as chromic acid, nitrate of silver, and chloride of zinc. It should be remembered that a very small orifice in the meatus is sufficient for the conveyance of sound to the tympanum. With the aural probe, save in cases where the chink is very small, there is seldom any difficulty in cleansing the meatus behind the exostosis. Surgeons may rely on the accuracy of the statement that if they only interfere by operation on those cases in which the deafness and subjective symptoms depend

solely on occlusion of the canal by exostoses, they will have but few occasions, in a lifetime, in which they will require to use a dentist's drill or an aural gouge.

Attention to the Middle Ear.

In treating of the middle ear I must be content with pointing out the main therapeutic indications to be fulfilled in any case in which the tinnitus may depend on an affection of the tympanum. They are primarily—

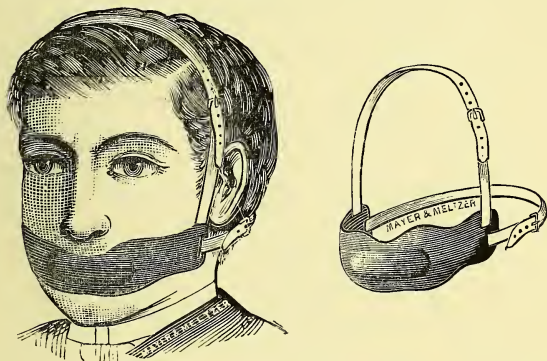
- (1) Attention to, and prophylactic measures against, acute and recurrent attacks of catarrh of the middle ear (otitis media).
- (2) The ventilation of the middle ear.
- (3) The patency of the Eustachian tubes.
- (4) Release of imprisoned secretions in the tympanum or Eustachian tube.
- (5) Improvement in the condition and position of the membrana tympani.
- (6) Restoration of tone and function to the intrinsic muscles of the middle ear and Eustachian tube.

I am here forced from want of space to limit myself to a few practical suggestions on each of these heads.

In the matter of prophylaxis the same rules apply as in the case of chronic rhinitis. The common sequence of events narrated by the great majority of patients who suffer from a recent tinnitus is "cold caught" when "out of sorts," a "stuffy or woolly" feel in the head and ears, succeeded by slight deafness and noise. Everything that tends to cause congestion of the mucous membrane must be shunned, excess in alcoholic drinks, exposure to the cold air on coming from warm buildings and rooms, cold bedrooms, chills in undressing or in bathing, light underclothing, cold and damp feet, the use of eider-down quilts, imprudence in diet, indulgence in complex and stimulating dishes.

It is worthy of note that Urbantschitsch and others have found that those "after perceptions" produced by certain noises in persons under thirty, and lasting a given time after the objective source of sound, and to which he gave the name "positive after-images," have what he has called "subjective fields of hearing," and while some of these are situated in the forehead or back of the head, the seat of the "subjective field" has also been found in the naso-pharynx (Politzer).

FIG. 37.



Oral Protector of Author (to prevent oral breathing at night).

The pathological relation between congested and hypertrophic conditions of the Schneiderian membrane and excessive sexual indulgence is of interest in connection with this physiological fact. Patients have often expressed to me the fact that the tinnitus was aggravated by frequency of the sexual act, or by seminal emissions.

The naso-oral respirator, recommended by Dr. Whistler, is a useful protective, so are small roles of cotton wool worn in the nostrils, or Gottstein's plugs

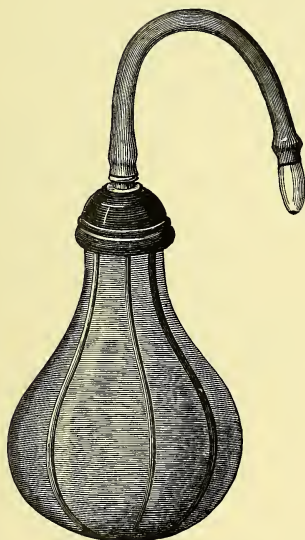
which are inserted with a little screw shank, and released by a reverse turn of the screw. An occasional vapour or Turkish bath, with a thorough shampooing, is an excellent prophylactic and arrester of rhinitis, but it is a risky remedy in one predisposed to otitis media. I direct some patients* to wear an oral covering, which compels respiration through the nose (Fig. 37). This is easily slipped on at night. I wore such an appliance myself for some time, and found it most beneficial. It completely prevents oral respiration during sleep.

Climate has much to say to the liability of such attacks. A dry and sheltered locality is the best for these sufferers. Too great exposure to what is popularly called a "bracing" air is not to be recommended. Bath, Ilkley, Malvern, Tunbridge Wells, Torquay, Brighton, Hastings, Bournemouth, Eastbourne, Cornwall, the Isle of Wight and Southsea are among the best of our home resorts. Abroad, I prefer Aix-les-Bains, Royat, Bourboule, Cauterets, Algiers, and the Canary Islands. In the early summer, Schwalbach and Kreuznach, Ems and Wiesbaden; later on, the Swiss Riviera. In the winter Cannes and Nice; or, better still, for those who will go, a winter at Davos, St. Moritz or Pontresina. If sulphur waters are indicated in gouty conditions, Harrogate and Strathpeffer are our two best home waters, while on the continent Aix-la-Chapelle (Aachen), Barèges, Bonnes and Eaux-Chaudes give us ample choice. But to the worn out city worker who suffers from tinnitus and a tendency to catarrhal states of the throat, Eustachian tube and middle ear, and who wants to combine rest of mind and relaxation with benefit to his local affection, I advise, at the proper season, and before any other place, Switzerland with its glorious air

* Those who have a habit of sleeping with the mouth open and who have no nasal obstruction.

and sky, its marvellous change of scenery, at little cost of travel, and its mountain climbs. After this, perhaps, the Mediterranean trip to Suez and back in a P. and O. vessel is to be recommended. But we must not overlook the fact, that to many, continental travel is an impossibility, and for these the Scottish Highlands, a trip

FIG. 38.



Poltzer's Inflator.

through the Caledonian Canal to Strathpeffer and Pitlochry, or a stay in the lovely Teviotdale may be recommended. Matlock and Malvern or Ilkley have each their advantages in individual cases.

In regard to the other indications I have mentioned, if a patient who suffers from recurrences of middle ear catarrh and Eustachian closure is subject to tinnitus the

ventilation of the tympanum will demand close attention. Here the occasional use of Politzer's inflator will be of service. If the surgeon does the simple act himself he will proceed thus:—A bag such as that shown in fig. 38 (I prefer the piece of tubing cut short so as to project about two inches from the pipe) is taken in the right hand and grasped lightly. The patient, seated opposite the surgeon, is made to take a sip of water, which he is directed not to swallow. The rubber nozzle of the bag is now inserted horizontally in the floor of

FIG. 39.



Poltzer's Inflator in use.

the nostril, and the nostrils are closed on it with the finger and thumb of the other hand. The patient is then directed to swallow, and immediately at the commencement of the second act of deglutition the bag is sharply compressed.

Poltzerisation.

I have, in the course of time, come to adopt some suggestions of Gruber, Schwartz, Lucæ, and Löwen-

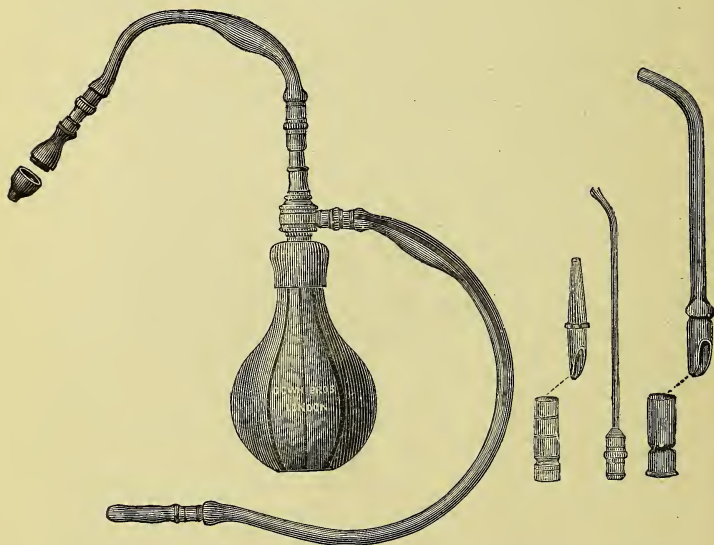
berg, in inflation of the tympanum. "If I allow," says Gruber, "the patient to incline his head strongly towards one shoulder during this treatment, it is always successful, especially if I pass the nozzle into the nostril which corresponds to the ear into which I wish to inject the air. In those cases in which the air comes into the ear of the other side as well, it almost always happened that the patient could feel the passage of the air more strongly in the upturned ear. The nasal pronunciation of the vowel *a* as suggested by Lucæ assists the inflation in some cases more satisfactorily than the act of swallowing."*

In the paper read by Löwenberg in 1876 (International Otological Society's Transactions), on the consequences of closed Eustachian tube, he contrasted the change taking place in an artificially shut bronchus with that happening in the tympanic cavity with an intercepted Eustachian tube. He then suggested, with a view to substitute for atmospheric air a gaseous compound that will not suffer diminution in the tympanum, being as near as possible in its nature to the mixture which results from a previous interchange (and which must necessarily behave quite differently towards the blood in the tympanum from the unaltered air), the periodical inflation of previously respired air, composed of nitrogen, a large quantity of carbonic acid, a very little oxygen, warmed to the body temperature, and saturated with watery vapour. To get the required compound, the patient is made to take a deep inspiration, hold the breath for as long a period as possible, and then expire. I tried several forms of inflating bag with the desire of meeting Löwenberg's suggestion. My object was to obtain an insufflator which would enable a patient to readily ventilate the tympanum, and also to insufflate

* *British Medical Journal*, May 3, 1884 (paper by author).

the middle ear with the air he had inspired, or with air charged with any vapour it was found desirable to pass through the Eustachian tube. This bag I do not, as a rule, use to practise Politzer's method with myself,

FIG. 45.



Author's Universal Auto-Insufflator, with mounts for nose, mouth, larynx and Eustachian catheter.

I generally employ his original hand-balloon with the nozzle attached. With it, when desirable, greater force can be employed. The *auto-inflating* bag is most easily applied by the patient, and the swallowing of a little saliva, or the pronunciation of the vowel *a* is quite sufficient to assist the act. The bag should not be forcibly squeezed, but should be compressed by a *sharp stroke*, when held *lightly* between the fingers and thumb. The

nozzle is directed *horizontally* and not vertically, the opposite nostril to that in which it is inserted being closed (Fig. 41). Quite recently Messrs. Down have, at my suggestion, introduced valves into the nasal (or oral) and side tubes, and have made the appliance still more perfect. It can be used for aural, nasal, or oral insufflation. By attaching a nasal or laryngeal insufflator to the tube any powder may be blown into the nose or throat, and by adapting the side or aspirating

FIG. 41.



Shewing method of holding nasal piece in introducing it into the nostril ; the thumb secures it in and closes on it in the right nostril, while the forefinger is ready for closure of the opposite nostril.

tube to an inhaler a vapour may likewise be insufflated. I show the improved insufflator attached to a Basdon's chloride of ammonia inhaler (Fig. 42).

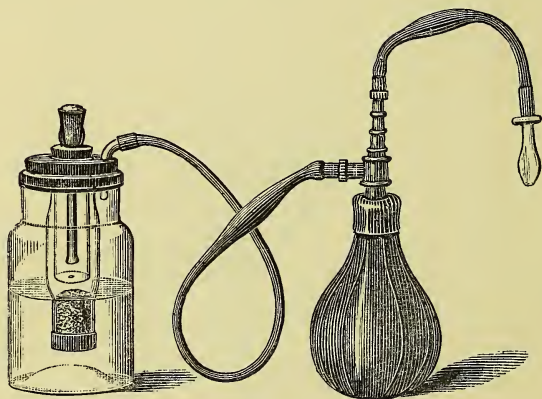
I think the following hints may be of service in practising Politzer's method :—

1. Let the patient be seated—at times patients become slightly giddy on inflation of the tympanum.
2. Make the patient swallow some sips of water in

rapid succession, or pronounce, through the nose, the vowel for a few times—this assists in opening the Eustachian tube, and is a form of “gymnastics” of the palatal muscles.

3. Incline the head to either side—inflate through the nostrils opposite to the side to which the head is inclined.

FIG. 42.



Auto-Insufflator attached to Basdon's Chloride of Ammonia Inhaler.

4. Direct the current—horizontally.

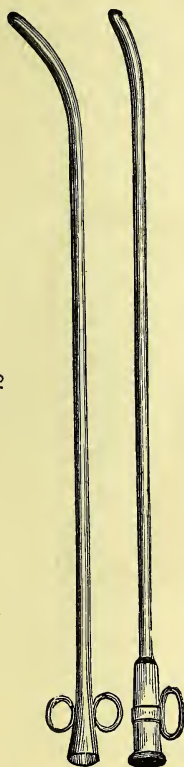
5. Experimentally ascertain whether any form of nasal phonation or the act of deglutition best dilates the aperture of the Eustachian tube. Adopt this method with the individual case.

6. After Politzerisation make the patient again swallow several sips of water.

7. With children phonation is the best act to take

advantage of; we can, as a rule, inflate when the child cries, with the auto-inflating bag there is seldom any

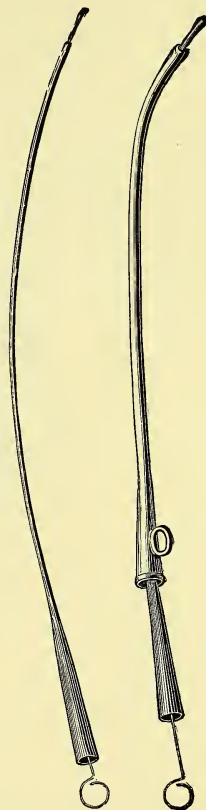
FIG. 43.



Eustachian Catheter.

FIG. 44.

Weber-Liel's Eustachian Catheter.



Same passed through ordinary Catheter.

difficulty—children quickly learn to inflate the middle ear.

It may be necessary to use the Eustachian catheter in order to inflate the tympanum through it with a Eustach-

ian bellows. Or we may test the patency of the tube by the passage of one of Politzer's or Weber-Liel's fine catheters or bougies. Having done so, the surgeon can gently douche the faucial orifice of the tube with an alkaline solution of carbonate of soda (grs. x., ad ʒi),

FIG. 45.

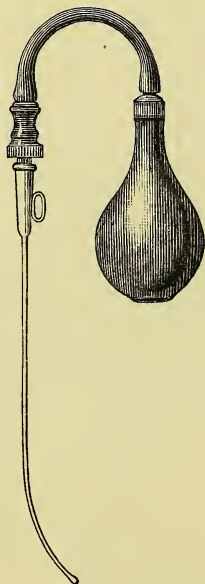
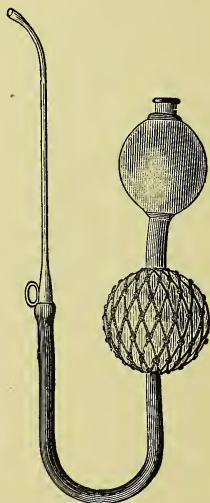
Catheter with small Bag attached
for Douching.

FIG. 46.



Catheter with Bellows attached.

iodide of potassium (grs. iv., ad ʒi), chloride of ammonia (grs. iv., ad ʒi). It is possible some portion of such

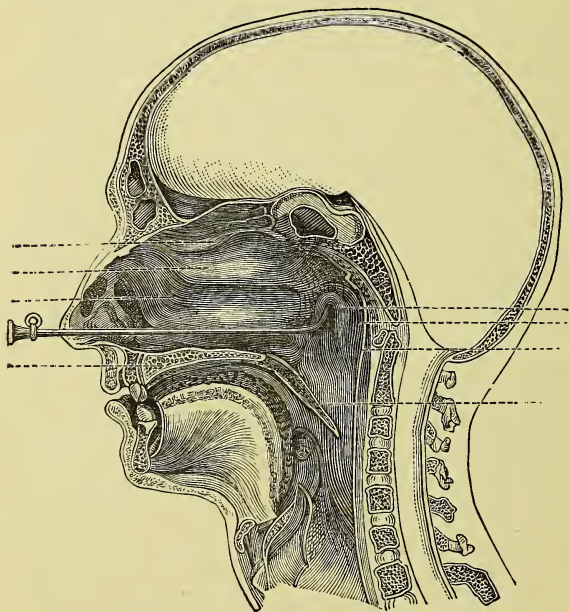
solution may reach the tympanum, and under all circumstances the gentlest force must be used in the act of injection. After using the injection, and when the catheter is withdrawn, direct the patient to hold the head forwards; let any retained fluid run through the nostrils and then make him swallow a few sips of water, finally using the hand bellows to inflate the tympanum. Immediately ascertain what the effect is on the tinnitus. The surgeon can vary the nature of the solution he uses, and, once the Eustachian tube is patent and that he is certain by the aid of the otoscope that the fluid has reached its destination, he will be able to say, after a few trials of this treatment, whether it is likely to affect the noises or not.

The following hints on the passage of the Eustachian catheter may be of service:—The catheter, held lightly between the forefinger and thumb of the right hand, the left being in readiness to transfer to it, has its curved point directed downwards, introduced into the nostril; the hand being then raised, the catheter is carried lightly and quickly (unless there be any obstruction) *horizontally* along the floor of the nares, all force being avoided, until the pharynx is touched posteriorly. The instrument is then drawn gently forwards, about half an inch, at the same time that it is rotated upwards and outwards, until we know, by the direction of the ring on the outer end that it is turned towards the ear. It is then felt in the tube, having ridden over the posterior lip, and we verify the success of the operation by inflation with the Eustachian bellows. Löwenberg and Politzer recommend a plan which it is well sometimes to adopt if we miss the orifice, namely, to turn the catheter in, withdrawing it from the pharynx inwards, with its point in a direction downwards, until we feel it against the septum, and then, by rotating the

catheter outwards and upwards, to turn it towards the Eustachian tube.

The essentials to success are—a thorough knowledge of the situation of the opening; a light hold of the instrument, which we introduce with the forefinger and

FIG. 47.



Eustachian Catheter in position (Politzer).

thumb of *either* hand; the beak of the catheter should be directed well downwards, and glided along the floor of the nares, avoiding the turbinated bone; tact in not turning the point into the fossa posterior to the pharyngeal orifice of the tube.

It is of importance to be able to pass the catheter with either hand with facility. Frequently a patient, just as he finds the sensitive anterior part of the nose touched by the catheter, raises his hand to catch the operator's. It is well to have the left hand in readiness, so that while we restrain the patient with the right, we continue quickly the passage of the catheter with the left hand, which we transfer to it.

If the surgeon determine to try to inject the tympanum through the Eustachian tube, it is well to use one of Weber-Liel's tympanic catheters, with a Pravaz syringe. With this appliance, if the Eustachian tube be patent, we can safely inject the tympanum with the desired solution (*vide* "Handbook," Fig. 46). With such a forceps as that of Turnbull (Fig. 50), we can easily mop the orifice of the Eustachian tube and the posterior nares with any solution we desire. I must confess that I do not of late resort to the use of chloride of ammonia vapour as frequently as I used to. Still, it is a remedy worth while trying in those cases of tinnitus in which we have general naso-pharyngeal relaxation and accumulation of mucus in the naso-pharynx and the Eustachian tubes. It matters little which inhaler we use, provided we get the neutral fumes for inhalation. Kerr's inhaler was one of the first used, and is a very simple one. Messrs. Godfrey and Cooke make an excellent inhaler, and so do Messrs. Burroughs and Wellcome. If we desire to pump some of this vapour or that of iodine into the tympanum through the Eustachian

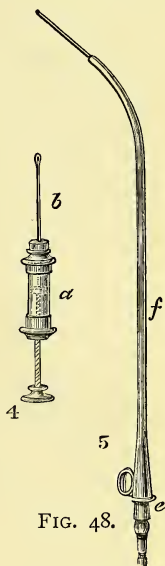
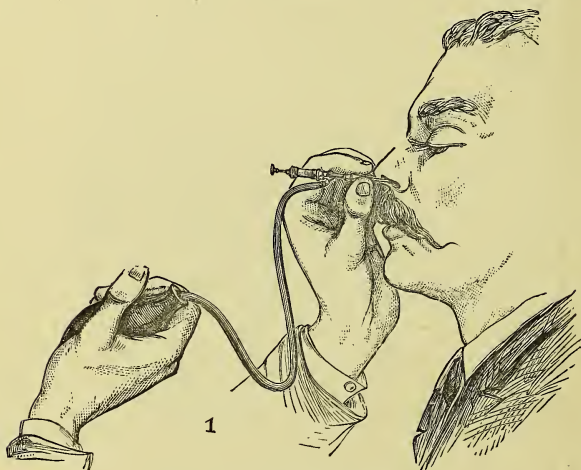


FIG. 48. Koniontron.

tube, we can easily do so by means of my auto-insufflating bag.

Some years since I had cigarettes made containing iodoform and iodol and eucalyptus for smoking purposes. I found that the iodoform was in great measure disguised by the eucalyptus, and more so, by vanillin or coumarin.

FIG. 49.



Weber-Liel's Koniontron in use.

I have had them made up with a little crow's-foot leaf. These can be smoked through the nose, and some of the vapour may be passed behind the naso-pharynx, or by Valsalva's method, into the tympanum.*

In all these chronic cases of middle ear catarrh with Eustachian complications, it will be well to direct the

* Messrs. Corbyn, Stacey and Co.

patient to use some alkaline and astringent gargle a few times daily while lying on the back and to direct him to

FIG. 50.



Turnbull's
Eustachian
Forceps.

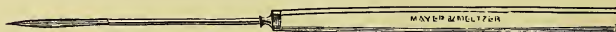
practise throwing the fluid behind the soft palate and against the posterior nares. In cases of tinnitus, in which there are abnormal conditions of the membrana tympani, either in the form of thickening, adhesions, displacements, atrophies, collapse, in my experience but little can be done for the subjective noises. Various plans may be tried when, in consequence of Eustachian closure or collapse, there is inward displacement of the membrana tympani with increase of tension. In addition to the use of Eustachian injections and bougies, with free inflation, we may try systematic suction on the tympanum through the meatus. Such suction we may first test the effect of with the pneumatic speculum, and then instruct the patient to apply suction himself, through a piece of tubing with an ear piece at one end which is covered with india-rubber, so as to fit the meatus air tight. On the other hand, we can adopt the plan advocated first by Dr. McKeown, in cases of considerable concavity of the membrane, of applying a little collodion to it, and making gentle traction by means of an artificial cotton-wool membrane, or

armed probe, on the drumhead. When the membrane bulges, or there is any doubt, after the careful use

of the otoscope and speculum, that some secretion may not be imprisoned within the tympanum, the best step to decide to take is paracentesis of the tympanum. Whether for this purpose, or for relief of tension, there can be no question that paracentesis often gives great relief to tinnitus. Unfortunately with the difficulty of keeping the opening patent, this troublesome symptom recurs. But this is not always so. Elsewhere I have fully entered into the results of my experience, and the advantages of, and various methods of performing this operation.

It is one, which, if performed with care, is generally devoid of danger. A sharp cataract needle, ordinary migringotome, or such a knife as that here figured, may be taken. (Fig. 51.)

FIG. 51.

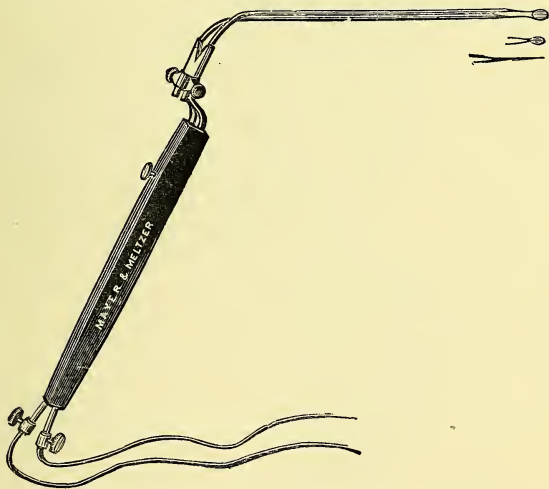


Knife for Paracentesis Tympani.

The patient is placed sitting opposite a good light with the head fixed, the mirror throwing the light well down on the membrane through a wide speculum. A small lance-headed knife shaped like a very fine cataract knife (a sheathed instrument is preferred by some) is carried steadily down to the membrane with the edge of the blade turned up. The membrane is punctured, generally, behind the handle of the malleus, the blade being carried up to any extent the operator sees fit. There is no bleeding, and but very little pain. I prefer a knife with a long handle, shaped like a small cataract knife, with but one cutting edge. The shank of the blade may be set at an angle to the handle. In chronic cases, for some days before performing the

operation, it is a precautionary measure to thoroughly Politzerise the tympanum, and to use a warm carbonate of soda douche with the Eustachian catheter. Free inflation with Politzer's bag should be practised after the punctures, and the patient can resort to Valsalva's method, so as to force any fluid serous secretions or mucus through the aperture. The patient should exercise caution after the operation—avoid cold and stimulating diet.

FIG. 52.

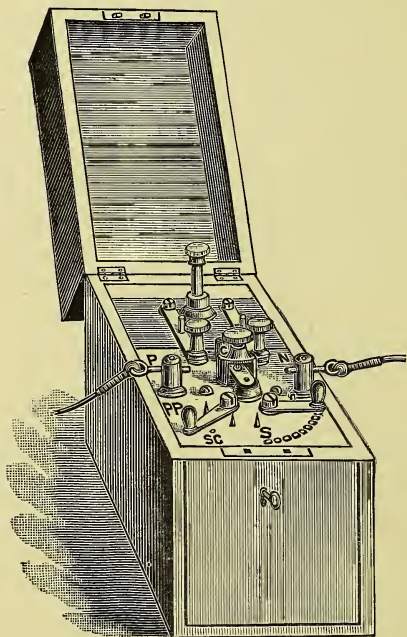


Galvanic Points for Paracentesis and Cautery.

Gruber recommends "multiple incision" of the membrane for excessive tension, making four or five cuts, and, when it is desirable, connecting these incisions by a transverse one, so as to resemble the letter H, dividing the membrane from the malleus towards the peri-

phery. Here we are at once brought face to face with such operations as myringectomy (Gruber), separation of adhesions (Wreden), division of the tensor tympani, or division of the tendon of the stapedius muscle with separation of the incus from the stapes (Weber

FIG. 53.



Faradic Battery.

Liel), removal of the ossicles (Sexton). These serious operations, which are undertaken with very variable results, I do not stay to discuss here. All are outside the province of those who have not had very exceptional operative experience, both on the living and dead

body. None of them are in very special favour in this country. All will be found fully discussed elsewhere, and in the larger treatises on otology (*vide* "Handbook)."
The morbid conditions for which these steps are undertaken are atresia of the Eustachian tube, considerable increase of tension of the membrana tympani, great thickening of the membrane, adhesions of the membrane and the ossicles, fixation of the stapes from rigidity of the stapedius muscle.

Restoration of tone and function to the muscles of the Eustachian tube.—This end will be accomplished partly by some of the measures already recommended for treating the naso-pharynx, both local and constitutional. Mild Faradization of the tubal muscles should be tried. The best battery to employ is the one here figured, and the small reophore of the author will be found convenient for conveying the primary current. It is readily passed in the same manner as a Eustachian catheter, the small piece of sponge at its end having been first dipped in a solution of common salt. The current may be completed by an elastic band, holding a brass disc similar to that used for faradising the larynx, or with a second ordinary laryngeal electrode. The brass disc can be placed over the mastoid or on the neck, or the knob of the electrode can be carried against the soft palate, over the mastoid, or beneath the ear. Contact is made and broken by the levers, or the clip devised by me (Fig. 55) can be adjusted, and thus can be used both for the faradic and galvanic currents. I judge of the strength of the current by its effect on my own and the patient's lip. The strength should never be more than what is easily borne, and no shock should be felt. With the second electrode we can complete the current in any part of the external auditory passage we choose, being careful to have the current weak. I may here

say that this is the only form of electricity used for the specific objects of influencing paretic states of the tubal muscles, and in some cases of the intrinsic muscles, that I have any confidence, or, indeed, much experience in

FIG. 54.

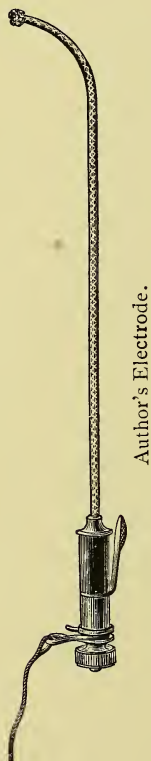


FIG. 55.



the utility of. I believe in it as an occasional means of correcting such conditions, and with other remedies at our command of alleviating thus indirectly the tinnitus.

It has as often disappointed me. On the other hand, from the good it has, I might say unexpectedly, done in those cases in which tubal and middle ear troubles have been at the source of tinnitus, I always give the patient the benefit of the doubt, and try faradism for some sittings, when if I find there is no result I abandon it (the galvanic current I shall* refer to in speaking of its application in cases of labyrinthine deafness).

In such cases, weakened states of the palatal and tubal muscles, occasional gargling in the horizontal position is of use in exercising the muscles. The patient should be made to swallow rapidly several sips of water, so as to pass the entire muscular mechanism of the soft palate through a series of gymnastic exercises. The periodical passage of the Eustachian bougie does good in much the same manner, not alone freeing the Eustachian orifice, but by stimulating the muscular tunics of its valve-like walls, especially if we follow up such excitation by the muscular actions associated with repeated acts of deglutition.

Such patients are frequently anæmic, and iron in some form must be administered cautiously. In the case of female patients I prefer the combination :—

R̄ Acid Arseniosi	...	...	grs. $\frac{1}{36}$ — $\frac{1}{40}$
Ferri Sulph. Exsic	...	...	gr. $\frac{3}{4}$
Quinæ. Sulph.	...	...	gr. 1
Ext. Nucis Vom.	...	...	gr. $\frac{1}{4}$
Ext. Gent.	...	...	q. s.

F. Pil. To be taken three times in the day.

A little St. Raphael wine given with meals a few times daily, where wine can be borne, will be of service for such anæmic patients. Strychnine is of special use

* Vide p. 126.

in these paretic cases. An admirable mixture is that of:—

R _x Liq. Strychniæ ...	...	...	ʒi.
Liq. Acid Phos. (Horsford) ...	...	...	ʒj.
Syrupi Aurantii ...	...	...	ʒi.
Aquam ad ..	...	...	ʒx.

Half an ounce to be taken three times in the twenty-four hours.

Another valuable combination is a teaspoonful of Horsford's acid phosphates and one of Fellows' compound syrup of the Hypophosphites, taken before meals a few times daily. In other nervous or hysterical cases the salts of zinc appear to act beneficially, more especially the valerianate and sulphate; for example such a pill as:—

Acid Arseniosi ...	...	...	gr. $\frac{1}{35}$
Zinci Valerianatis ...	...	...	gr. $\frac{1}{2}$
Ext. Nucis Vom. ...	...	...	gr. $\frac{1}{2}$

which may be given with benefit with other tonics. The patient, when possible, should be advised change of air and scene, avoidance of overwork, night work, late hours, much railway travelling, night nursing, and those prejudicial influences alluded to in dealing with catarrhal states of the nose and middle ear.

The Internal Ear.

We turn now to the internal ear. We have to remember how seriously disturbances of equilibration of the air in the middle ear, altered relations of tension of the membrane of the tympanum, and perverted action of the ossicles, either through rigidity, displacement or clogging of any or all of them, must effect the acoustic conditions of the labyrinthine fluid. It is, therefore, obvious that in treating the abnormal states of the

tympanum, its membrane, its valvular outlets and its intrinsic muscular apparatus, we are indirectly dealing with the labyrinth, and may possibly remove the primary cause of the labyrinthine disturbance. We have here to consider rather how far we can influence such abnormal states of the auditory nerve itself or of the circulation in the labyrinth as are likely to cause tinnitus. This is most difficult in the outset from the obscurity that surrounds both the physiological and pathological causes of the noises we are anxious to relieve. Some of these conditions we have already regarded as beyond the reach of any therapeutical act or agent. We may, however, determine certain sources of excitation of the nervous structures. And we may further endeavour to differentiate those sources of irritation which have their starting point in the labyrinth from those which are reflected from the centre or from some intervening parts of the auditory nerve. But this effort to clear the ground for a rational therapeutics, in the present state of our knowledge, only enables us at best to generalise in grouping means or remedies likely to relieve. We may make such a grouping with this object as the following:—

- | | |
|--------------------------------|---|
| I. NERVOUS
EXCITATION. | { The treatment of central irritations
that affect the labyrinth in a reflex
manner; of peripheral irritations that
may affect the labyrinth by reflex action.
Of irritations due to local excitations
occurring in some portion of the auditory
nerve :— |
| 2.
VASCULAR
EXCITATIONS. | { (a) Those consequent upon general
diminution of tension of the vascular
system. (b) Those consequent upon
general increase of tension of the vas-
cular system. (c) Those due to toxic
ingredients in the blood. |

3. { The treatment of such collateral sources
 COLLATERAL of irritation as may arise from tempera-
 EXCITATIONS. ment, habits, vices, occupations, heredi-
 tary tendencies and taints.

We may briefly summarise the lines on which we can hope to attack such predisposing causes of a tinnitus which has its origin in direct or reflected irritations of the nervous structure of the labyrinth.

Central and Peripheral Excitations as a Cause of the Noises.

We may have to treat the uric acid diathesis and latent gouty conditions, or that state of the blood brought about by quickly recurring and numerous pregnancies. Independently of general treatment, which we can pursue at home, such gouty patients who suffer from noises in the ears derive benefit from Homburg, Ems, Wiesbaden, Kissengen, Vichy, Bourboule, Harrogate, Strathpeffer, Bath, Buxton, Leamington. It is in these cases that the combination of the iodides of potassium, sodium, and ammonium, or the iodide of potassium, alone or combined with the bromide salt, do much service.

If there be attendant upon this gouty disposition (or otherwise), a torpid or enlarged liver and general biliary congestion, the exhibition of salines, an occasional mercurial and the more commonly administered vegetable cholagogues may mitigate, if they do not remove, the tinnitus. The bitter purgative waters of Rubinat, Æsculap, Hunyadi, Friedrichshale and Carlsbad are indicated. And if there be, as there often is in such persons, a degree of cardiac irregularity and an associated palpitation, such vascular tonics as digitalis, convallaria, or strophanthus should be given. Bourboule, Aix, Wiesbaden, Homburg, Ems, Marienbad and Carlsbad are among the most important of the waters to which such patients should be sent. It is not

necessary to insist on the importance of diet, the strict limitation or total abandonment of alcohol and great moderation in the use of tobacco. It is always worth the temporary trial in any case of tinnitus to abandon tobacco for a time, and the enforcement of the well-understood dietetic observances imposed on all large nitrogenous eaters as to the habit of smoking. Tobacco has also a tendency in many persons to increase the tinnitus, if not primarily to cause it. Remembering the influence of tobacco on the heart (Handfield-Jones), I should say that complete abandonment of the habit in the class of case I have just described is imperative. The lesson learnt by the action of tobacco in the retina in producing atrophy of the papilla and ambylopia should not be forgotten in the instance of the auditory nerve. Though we have not the same direct evidence of its effects, the possibility of tobacco deafness and tinnitus should be remembered. As with the eye so with the ear,—the total relinquishment of the practice of smoking gives the patient the best chance of recovery. Another attendant upon these disorders of digestion and mal-assimilation of food that requires to be carefully attended to when noise in the head or ears is complained of is flatulence. It is noteworthy the number of reflex symptoms to which flatus will give rise. I have known it to cause not alone tinnitus but sudden sharp pain in the ears. Diet here, again, is of importance. Raw vegetables should be for a time interdicted, and all others calculated to cause this digestive complication. Abdominal massage is of great value for such torpid livers and bowels. Administered properly and with care it is a splendid remedy. This applies more to sufferers from constipation. With it we may combine the galvanic ten cells of Léclanche elements in the course of the great bowel.

Uterine Disorders.—The frequency with which disorders of the female sexual organs are found attendant upon tinnitus is more than a mere coincidence. This is proved by the occasional disappearance of the noises when the sexual disturbance, or the condition it has given rise to, is cured. Pregnancy, large fibroids of the uterus, severe displacements, menorrhagia, the menorrhagia of the menopause, and other female diseases, which by pain cause exhaustion and general debility, may give rise to tinnitus. The time of life when women are most subject to reflex disturbances is that of the menopause. Then also it is that we frequently find that they suffer from exhaustive discharges. So we might expect that noises “in the head” and ears would be most likely to occur, and experience verifies the supposition. At the climacteric period we find those sudden changes in blood pressure which are so often fatal to the integrity of vessels elsewhere than in the uterus—as, for example, in the nose, the retina, the lung and the kidney. We might then expect to meet with these subjective aural phenomena at this time, or those graver objective consequences, apoplexies of the labyrinth, with the train of symptoms which are grouped together under the name of Ménière’s—attacks of vertigo, nausea, deafness and tinnitus—such graver results or lesions are more apt to follow in the instance of a woman whose blood has been subject to frequent drains and all the physiological changes of many pregnancies. Treatment in such cases must be directed to the vascular supply of the viscera, the prevention of congestion in such organs as the liver and kidney, maintaining the portal circulation, watching for waves of depression or exaltation in the vascular system generally, and more especially, the strength and regularity of the heart’s rhythm. We do this in a three-

fold manner:—First, by the judicious use of such cholagogues and aperients as are calculated to promote the flow of bile and prevent portal congestion ; secondly, the administration of such medicines as are proved to act as fingers to the central vaso-motor stopcock in controlling either excess or diminution of blood pressure ; thirdly, the periodical, but timely, resort to vascular tonics, more especially those calculated to act directly on the heart itself, in steadying and controlling its action.

In the eclectic remedies, iridin and euonymin, combined with mild aloetic aperients, and followed by salines we have examples of the first ; in the bromides of potassium and sodium, hydrobromic acid, pilocarpine, nitrite of amyl, hydrobromic ether, hydrastia, of the second ; and in digitalis, convallaria, strophanthus, of the third. There is another group of remedies that act more especially on the small vessels, and have a constringent effect on the arterioles which can frequently with this object be availed of in tinnitus with benefit, viz. : that containing belladonna, digitalis, ergot.* But independently of any general treatment the local conditions will require attention, displacements must be rectified, congested states reduced, menorrhagic discharges should be controlled, ovarian excitations subdued, sexual excesses moderated. I may here repeat what I have elsewhere said bearing on the subject of vascular pressure in relation to tinnitus.

We find two clearly distinct classes of patients in whom the symptom of tinnitus is present, the distinction being generally so evident as to broadly indicate the lines of therapeutic action. *In one group* there is slow

* Gruber speaks well of arnica in nervous tinnitus, 5 to 15 drops on sugar three times in the day.

and feeble action of the heart, perhaps attended by occasional intermittence; the pulse at the wrist varies in force and character—it may be full but compressible, or feeble and easily obliterated; the temporal arteries are dilated; the veins on the backs of the hands are unduly prominent; auscultation reveals an imperfect cardiac systole or diastole; the digestive powers are weak; there is a tendency to general nervous depression, and the occasional attacks of giddiness or faintness are evidences of cerebral anæmia.

It is in these cases we find benefit derived from such drugs as iron and its combinations, digitalis, convallaria, arsenic, quinine, strychnine, caffeine, ergot. The bromides have to be administered with caution, and it is a question if any temporary relief due to diminished irritability of the reflex and cardiac nerve centres compensates for the depression which is attendant on their prolonged employment. The bromide salts of caffeine, zinc, and iron will, however, often be found most valuable given in combination with other vascular and nerve tonics. I have constantly found hydrobromic acid with quinine and pyrophosphate of iron useful. The use of alcohol in such cases in any quantity I have little doubt is most injurious; the secondary dilatation of the arterioles which follows the use of alcohol, especially in the intervals between its administration, increasing the tinnitus, while the cardiac irregularity and gastric disturbance which it frequently causes still further adds to the mischief. A small and defined quantity of alcohol taken with food in cases of weak appetite, and such wines as St. Raphael, Burgundy, claret, and the red Australian wines are of service in anæmic states; though even this amount of alcohol we find in many persons aggravates the noises.

In the second group of cases there are the general

evidences of increased arterial tension in the incompressible radial pulse, throbbing carotids, rigid vessels, ocular phenomena, sleeplessness, headache, and sense of fulness in the head. We frequently find that organic changes in the vascular system or the kidneys accompany this increased arterial tension.

Aortic stenosis, and mitral insufficiency, aneurismal tumours, atheromatous degeneration, Bright's disease, contracted kidney, are perhaps the most frequently met with of these organic sources of tinnitus. In gout, rheumatism, chronic alcoholism, diabetes, and transitory glycosuria the same condition exists. It is present in females who suffer from erratic or suppressed menstruation, and is not uncommon at the menopause and during pregnancy. Excessive indulgence in tea may produce it. I have drawn attention to the frequent occurrence of tinnitus in the case of cerebral tumours and other degenerative changes both of the brain and spinal cord, and have elsewhere detailed the particulars of a case in which tinnitus aurium was the earliest symptom of the subsequent fatal growth in the brain, which ultimately involved nearly all the nuclei of the cranial nerves.*

It is especially in this increased tension tinnitus that bromide of potassium gives such relief. I do not think it is of equal value to hydrobromic acid, which is the most reliable medicine I know of for the relief of hyperæmic tinnitus. It should be given in thirty-drop doses, and may well be combined with such medicines as digitalis, convallaria, or quinine, when these are indicated. The hydrobromate of cocaine is likely to prove a useful agent for tinnitus in doses of a quarter to

* *Practitioner*, 1885, vol. xxxv.—“Short Notes on Therapeutics,” *Ocular Therapeutics*.

one grain. I have given, as first advocated by Turnbull, hydrobromic ether, held in suspension by a little powdered acacia and glycerine in three-to-five minim doses with advantage (see formulæ). It may also be blown into the middle ear through the Eustachian catheter. Nitrite of amyl and nitroglycerine will often afford temporary relief from the noise and throbbing in the ears. I have known inhalation of nitrite of amyl give great relief in several cases of tinnitus attendant on granular kidney, and in other forms of hydræmia in which the urine was of low specific gravity. Ergotin and sclerotic acid are valuable remedies in cerebral hyperæmic conditions attendant on cardiac irritability, and alone or in combinations with digitalis often mitigate distressing tinnitus. Hamamelis may be given for the same object in combination with ergot.

It is in this class of patients that the morning administration of some saline aperient waters following on such vegetable cholagogues as iridin, euonymin, podophyllin, or occasional small doses of mercurial powder or pill, will have a beneficial effect on the tinnitus.

Pilocarpine.—Here I come to allude to a remedy with which my name has a kind of historic interest (*vide* leading article in the *Lancet* of September 25, 1880). I believe I was one of the first in the United Kingdom who gave pilocarpine hypodermically as a vascular depressant and rapid diaphoretic. For nearly a year before the meeting of the British Medical Association in Cork in 1879, I had been using pilocarpine in ocular affections both locally and hypodermically, for the relief of glaucomatous states of the ocular vessels. As far back as that year I used it in a case of Ménière's affection due to syphilitic disease of the labyrinth.* And this experience and

* *Practitioner*, vol. xxxvi., p. 193.

knowledge of its action it was that led me to its use in the famous case, well known at the time as "The Pilocarpine Case," in which I employed it for suppressed scarlatina. The records of the case and the professional verdict on it can be found in the medical periodicals of the years 1880 and 1881. Suffice it to say that my use of the drug in that case cost me a hospital enquiry that lasted the greater part of a week, at which I fully vindicated my action, and what I have always regretted more, the *British Medical Journal*, for its defence of my treatment, was subjected to an action at law for libel. What value I have placed on pilocarpine in the treatment of affections of the labyrinth may be gauged from this quotation from the students' (3rd) edition of the "Handbook," and from the *Practitioner* of March, 1886.

"It is a question if we avail ourselves of the action of pilocarpine as frequently as we should.* It is probably the most certain and powerful of all our drugs in cases suitable for its administration, where the reduction of vascular tension is our object, and in which we desire to check effusion and control the tendency to extravasation. These are exactly the conditions in the earlier stages of Ménière's disease and other forms of vertigo in which labyrinthine effusions are threatening or occurring. At the Milan Congress (1880) Professor Politzer drew attention to the use of subcutaneous injections of pilocarpine in syphilitic exudations of the labyrinth, and then inferred that it might prove of service in other than specific affections of the internal ear. The strength of the solution he is in the habit of using, and which is nearly the same as that I have myself employed, is a 2 per cent. solution, injecting three to six drops into the arm for each dose. (1) The treatment may be abandoned if, after fourteen days, no result is apparent; otherwise it may be continued daily until a decided improve-

* Mr. Field has within the last few years verified this opinion by the successful use of pilocarpine in cases of tinnitus and deafness.

ment is manifest. This is attained in periods of time varying from six to forty days. It is not uncommon to find the progress vacillating. But as a rule the greatest advance is made during the first fortnight of the treatment. During the administration there should be no other local or internal treatment pursued. A few out of the several remarkable and typical cases instanced by Professor Politzer are well worthy of notice. (2) In July, 1871, a Russian gendarme contracted primary syphilis, which was followed by secondary symptoms, and was treated by mercury and iodine. In January, 1881, he was attacked by deafness of both ears, tinnitus, giddiness, sickness, and violent pain in the occipital region. The right ear was first affected, uncertainty of gait followed, especially if he was in the dark. The acoumeter (or Hörmesser) was not heard on contact with the right ear, or on the corresponding temple, while loud speaking conveyed only the idea of sound. With the left ear the acoumeter was heard at the distance of a meter and a half, and whispering at five meters. The tuning fork placed on the head was heard only with the left ear. Inflation made no difference. After the first injection of pilocarpine speech was heard at sixteen centimeters by the right ear, after the fourth at half a meter, after the eighth at four and a half meters, at the end of the fourth week the hearing distance of the left ear was normal and loud speech as heard at five-and-a-half meters.

“Another instance was that of a lawyer, aged thirty-two, who had been very deaf in the left ear from sclerosis and middle ear catarrh. In September, 1884, he contracted primary syphilis, which was followed by secondary symptoms, and an ulcerative pharyngitis. He was benefited by special treatment. A deafness supervened in the right ear, accompanied by tinnitus,

giddiness and headache. There were no changes apparently in the membrane, middle ear, or Eustachian tube. The acoumeter was not heard with the left ear, nor with this ear could he hear a loud voice. With the right ear the acoumeter was heard at a distance of four centimeters, and loud conversation at one third of a meter; no sound was heard through the cranial bones. The tuning-fork was heard with the left ear longer when the fork was placed on the mastoid process than when it was held to the ear. It was the reverse with the right ear. The deafness in the left ear was doubtless due to stapedia fixation, and loss of sound conduction; in the right ear to syphilitic effusion into the labyrinth.

“Without going into daily progressive improvement under pilocarpine injections, it will be sufficient to state that after the thirty-second injection the hearing of the right was normal, and the subjective noises had disappeared, and the interference with the musical perception was completely removed.

“We may thus summarise the conclusions of Professor Politzer with regard to the use of pilocarpine injection in affections of the labyrinth. (*a*) It is in syphilitic affections of the labyrinth that it is of most service; (*b*) in those syphilitic cases which may be regarded as hereditary it is of less use; (*c*) in cases in which there has been middle-ear disease, arising out of diphtheria or scarlatina, pilocarpine is useless; (*d*) it is useless in old cases following on meningitis, or cerebro-spinal fever, though in recent cases (Jacobson) it may be tried with success; (*e*) there is a large percentage of failures in advanced cases, but the success of the treatment is sufficient to warrant its employment in recent and more desperate cases of so-called “nervine deafness”; (*f*) it should be administered early in the deafness, and persevered in for some time; it is harmless in its operation given in the doses before recommended.”

While I thus appraise at its true value this agent both for lowering vascular tension in the labyrinth, and promoting the absorption of effused products, I have to protest against its indiscriminate employment in all cases of tinnitus and deafness, attended or not by vertigo, as the purest charlatanism. If we can exclude gross middle-ear changes and irremediable labyrinthine lesions, and if we are able to trace the aural subjective phenomena to vascular pressure in the labyrinth, let it arise how it may, or to recent effusions of serum or lymph into the labyrinth, then pilocarpine may rationally be expected to do good, and not otherwise. To use it without such discriminate precautions is to bring the drug itself into contempt, and otology into disrepute. Used in the manner indicated by Politzer, and with proper precautions, to encourage perspiration and prevent chill, I have not had any bad effects from pilocarpine. It is best to begin with the smaller doses and gradually increase in strength and frequency, according as the patient bears the effects of the injections.

Dental Reflexes.—In referring to reflected peripheral excitations, I must not omit a reference to those arising from the teeth. In a paper on “Dental Reflexes,”* recently published, I alluded to tinnitus and deafness as possible reflex symptoms arising out of disorders of the teeth. This cannot surprise us when we remember the numerous communications of the trigeminus with the other cranial nerves and their nuclei. I do not, however, think that such aural reflexes are of frequent occurrence. We might expect to find them more frequently with eruption of the wisdom teeth. But indirectly through loss of sleep caused by facial neuralgia, headache, and the nervous prostration which we fre-

* *Dental Record*, September, 1890.

quently find present with painful carious stumps, tinnitus may be induced by dental periostitis and caries. At least the teeth, in any persistent case of tinnitus, in an enfeebled person, should not be above suspicion and inspection. Indeed it is well to seek for any collateral source of excitation in the other cranial nerves, as well as the auditory itself. It is conceivable that the prolonged irritation caused by astigmatism and its secondary consequences, in persistent headache, vertigo and nausea, might start in the ear such a subjective phenomenon as tinnitus. As a fact, I have known, whether as a coincidence or otherwise, on several occasions in an astigmatic sufferer, tinnitus to be present. As it has a bearing on this subject I reproduce that portion of my communication on "Dental Reflexes," more especially touching on tinnitus aurium.

"In the record of neuralgia of the fifth and facial nerves associated with tinnitus aurium, I found that out of 260 cases of tinnitus, seven were suffering from neuralgia of these nerves, and seven more complained of severe headache. Though I have no record of the condition of the teeth in these cases, still I am aware that in many the teeth were affected, and it is only reasonable, on physiological grounds, to infer that the decayed teeth may have had a share in causing the tinnitus, or in starting the morbid condition of the tympanum which accompanied it. Rarely, however, in aural cases is *deafness* attributed to the teeth. This is my experience. This may arise from the patient and surgeon overlooking the teeth as a probable source of the ear mischief. Neuralgic and radiating *pain* in the ear associated with dental pain is common. In the eruption of the wisdom teeth such pain is not unusual. Still, occasionally, the origin of deafness is ascribed to toothache. A lady, aged thirty-four, consulted me in 1888 for deafness and

tinnitus. She was positive the deafness at first appeared when she was suffering from severe toothache. There were carious teeth of the upper and lower jaw. She was quite healthy in every other respect. The membrana tympani of either ear was rigid; there was collapse of the Eustachian tube—she had the teeth attended to but the deafness and tinnitus continued.

“I have this day seen a patient with white and gold stoppings in the upper and lower left molar teeth and overcrowded incisors; she suffers from periodical tinnitus aurium of the left ear, the hearing is nearly normal, there is nothing discernible save some slight catarrhal changes in the membrana tympani, yet there is violent neuralgic pain apparently starting in the ear and radiating in the course of the facial branches. This lady has been wearing a pessary for some time for retroversion of the womb, to which she ascribes all her ills. And many times I have known neuralgia of the ear, occurring without any inflammation or other abnormal conditions of the ear, unquestionably due to a carious tooth, and the pain has been immediately relieved by its removal. Such neuralgic attacks are, as I shall show, accompanied occasionally by tinnitus. Such a local symptom generally points either to an interference with the equilibration of the air in the tympanum or the fluid in the labyrinth, or at least to sufficient irritation in the auditory nerve tract from nucleus to cortex, to start this symptom. The communications of the fifth with the facial and auditory nerves through the otic and spheno-palatine ganglia; the distinct supply of the tensor tympani by the fifth nerve, and of the stapedius by the facial—the two muscles which are most important in regulating the equilibration of the fluid in the labyrinth—offer the anatomical explanation of such a reflex aural irritation springing from

a dental cause in the superior or inferior dental branches of the fifth nerve. This possible reflex disturbance of the fluid equilibrium in the labyrinth, through an irritation existing in the teeth, demands additional attention in face of the fact stated by Foster that the 'activity of the tensor tympani is regulated by reflex action.' Nor in estimating the various reflex relationships of fifth nerve must the fact be overlooked that at its origin the sensory root of the fifth anastomoses, with all the motor nuclei of the nerves arising from the medulla with the exception of the abducens (6th) (Landois and Stirling).

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CHAPTER VI.

SOME ANATOMICAL POINTS BEARING ON REFLEXES
OF THE TRIGEMINUS.

*THERE are some anatomical points in regard to the connections and communications of the fifth nerve which are of interest to remember in discussing any of those reflexes which irritation of the dental branches may produce. It may be well in the first place briefly to tabulate these.

1. Nuclei of origin of Fifth.

The connection of the motor nucleus with the cortical motor centre of the opposite side, and its connection with the descending root. The anastomosis of the sensory root with all the motor nuclei of the nerves, arising from the medulla save the sixth—(LANDOIS and STIRLING).†

2. Distribution to dura mater and arachnoid from fifth nerve.

The supply of the dura mater from the fifth nerve through the recurrent branch from the Gasserian ganglion, superior maxillary, ophthalmic division of fifth; the communications between the branches of the carotid plexus of the sympathetic going to the dura mater, with the Gasserian ganglion and Meckel's ganglion, through the vidian. Besides the facial and spinal accessory, the motor division of the inferior maxillary of fifth sends a branch to the arachnoid; while the fifth also participates in the supply of the pia mater.

3. Distribution to scalp and communications of Fifth.

Supra-trochlear, infra-orbital, from ophthalmic; temporal of orbital, from superior maxillary; auriculo-temporal, from inferior maxillary. "*All the cutaneous offsets of the fifth nerve, form communications with the adjacent ramification of the seventh nerve.*"—(QUAIN). The intercommunications between the great auricular, small and great occipital (from the second and third cervical nerves) and the posterior auricular of the facial, form a connecting link between the cutaneous branches of the second and third cervical, and the fifth nerves. This anatomical connection has an important bearing on the concurrence of cervical with dental neuralgia.

* See page 11. † *Landois and Stirling*, "Text Book on Physiology," 1889.

Important communications of fifth with other cranial nerves.	With the Facial.	Through the Chorda tympani; temporo-facial and temporal; malar; infra-orbital; buccal; supra-maxillary.
	With the Auditory.	The upper division of the auditory nerve communicates with the geniculate ganglion or facial, and so, by means of the large and small superficial petrosal nerves, with Meckel's and the otic ganglion, respectively.
	With the glossopharyngeal.	Jacobson's "tympanic branch" with the small superficial petrosal and otic ganglion—section of the fifth nerve is followed by inflammatory changes in the tympanum of the rabbit—(BERTHOLD and GRUNHAGEN). Also in relation to <i>ocular</i> , <i>auditory</i> , and <i>nasal</i> reflex irritation, these distributions of the fifth nerve have to be remembered.
Other Distributions.	Eye.	The origin of the long ciliary branches through the sensory root of the lenticular ganglion; the infra- and supra-trochlear branches to the eye and lachrymal apparatus, the supra-orbital cutaneous twigs to the scalp and frontal pericranium. Communications with the third, fourth, and sixth nerves through the ophthalmic of fifth.
	Ear.	The communication through the otic ganglion with the tympanic plexus. The muscular supply from the otic ganglion to the tensor tympani and the tensor palati.
	Nose.	The supply through the branches of Meckel's ganglion, and the naso-palatine nerve, to the hard palate and the middle and inferior meati, soft palate, tonsils, septum nasi, and ethmoidal cells.

These connections and distributions of the branches of the fifth nerve are in themselves sufficient to explain some of the occasional reflex symptoms that may be traced to an irritation of dental twigs. The connections of the fifth nerve with the sympathetic are of primary importance in so far as they bear on the vaso-motor effects of irritation of the dental twigs. These effects are manifested in allied conditions of blood pressure; increase or diminution, in the ciliary circulation in the eye, in the vessels of the tympanum and labyrinth in the ear, and those of the septum and turbinate bones in the nose. The same observation applies to the scalp,

frontal pericranium, and dura mater. Though the auditory nerve in common with the optic and olfactory has no connection directly with the sympathetic, yet there are the communications from the carotid plexus with Meckel's ganglion through the deep and great superficial petrosal (forming the vidian), and the filaments that proceed from the sympathetic around the middle meningeal to the otic ganglion. There are indirect connections also through the tympanic branch of the glossopharyngeal and the communications with the facial nerve through its geniculate ganglion and its branch to the stylohyoid muscle.

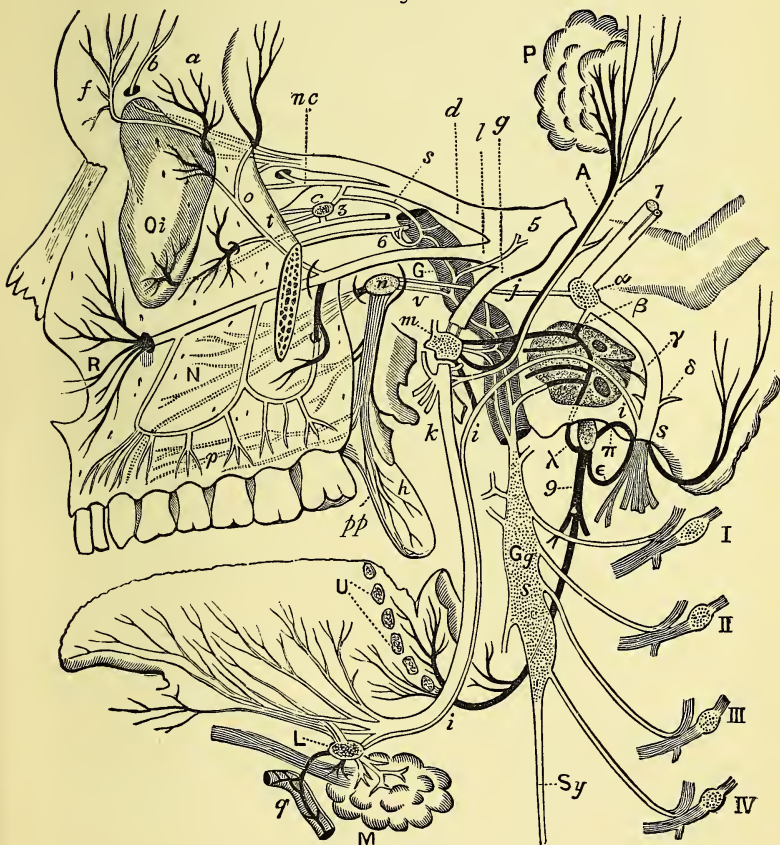
The vaso-constrictor fibres (contracting blood vessels) pass from the anterior roots of the upper dorsal through the sympathetic cervical ganglia (Gaskell) to the carotid artery, and thence to the special arteries supplying the parts before named. The vaso-dilators arising from the entire spinal cord find their way in the same manner to the smaller vessels. The knowledge of the existence of these distinctly opposed vaso-motor nerves, one diminishing the blood supply and raising the blood pressure, the other increasing it and lowering the blood pressure, helps to explain some of the seemingly paradoxical effects following on stimulation of the fifth nerve, as, for instance, an increase or diminution of the intraocular vascular tension from decayed teeth and supra or infra-orbita nerve excitation. Still more seriously touching on this question is the knowledge that "pressor" nerve fibres exist in the trigeminus which excite the vaso-motor centre in the medulla and cause a rise* of blood pressure.

* "Text Book on Physiology," by J. McKendrick, M.D., F.R.C.S., vol. ii., p. 294, 1889.

OCULAR NASAL AND AURAL REFLEXES.

Semi-diagrammatic representation (after Landois and Stirling) of the nerves of the eyeball, the connections of the trigeminus and its ganglia,

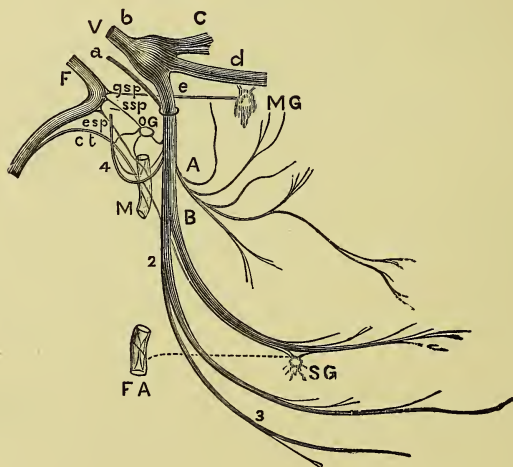
FIG. 56.



together with the facial and glosso-pharyngeal nerves. 3, Branch to the inferior oblique muscle from the oculomotorius, with the thick short root to the ciliary ganglion (*c*); *t*, ciliary nerves; long root to

the ganglion from the naso-ciliary (*nc*); *s*, sympathetic root from the sympathetic plexus surrounding the internal carotid (*G*); *d*, first or ophthalmic division of the trigeminus (*5*) with the naso-ciliary (*nc*) and the terminal branches of the lachrymal (*a*) supra orbital (*b*) and frontal (*f*); *I*, second or superior maxillary division of the trigeminus (*R*) infra-orbital; (*n*), sphenopalatine (Meckel's) ganglion with its roots; (*j*), from the facial, and *v*, from the sympathetic; *N*, the nasal branches, and *pp*, the palatine branches of the ganglion; *g*, third or inferior maxillary division of the trigeminus; *k*, lingual; *i, i*, chorda tympani; *m*, otic ganglion, with the roots from the tympanic plexus, the carotid plexus, and from the 3rd branch and with its branches to the auriculo temporal (*a*) and to the chorda (*i i*); *L*, sub-maxillary ganglion with its roots from the tympanico-lingual, and the sympathetic

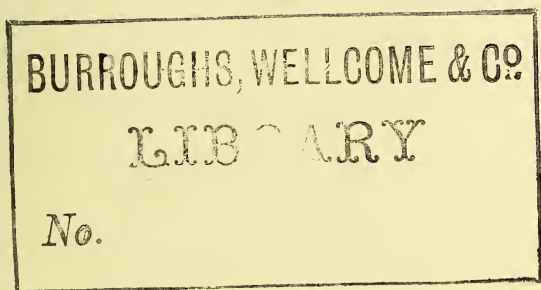
FIG. 57.

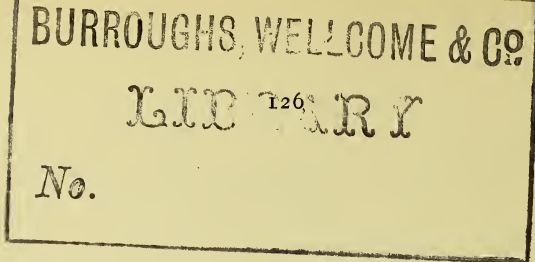


plexus on the external artery (*q*). 7, Facial nerve, *j*, its great superficial petrosal branch; *a*, gang, geniculatum; *β*, branch to the tympanic plexus; *γ*, branch to the stapedius; *δ*, anastomatic twig to the auricular branch of the vagus; *i i*, chorda tympani; *S*, stylo-mastoid foramen. 9, Glosso pharyngeal; *λ*, its tympanic branch; *π* and *ε*, connections with the facial; *U*, terminations of the gustatory fibres of 9 in the circumvallate papillae; *Sy*, sympathetic with *G g*, *s*; the superior cervical ganglion, I., II., III., IV., the four upper cervical nerves; *P*, parotid; *m*, sub-maxillary gland.

DIAGRAM OF THE THIRD DIVISION OF THE FIFTH NERVE, ITS
CONNECTION AND BRANCHES.

V—Fifth nerve. b, large sensory root with the Gasserian ganglion ; a, smaller motor root joining inferior maxillary nerve. A, anterior division of the inferior maxillary nerve with its branches to the muscles of mastication and buccal branch (mainly motor) ; B, posterior division ; 1, its lingual branch ; 2, the inferior dental branch, with the twigs to the teeth, and the mental branch ; 3, the mylo-hyoid branch ; F, the facial nerve with its (c t), chorda tympani branch going to (S G) sub-maxillary ganglion as its motor root. O G, otic ganglion ; g s p, great superficial petrosal connecting the facial nerve with (M G) Meckel's ganglion ; s s p, small superficial petrosal connecting the facial nerve with the otic ganglion ; e s p, external superficial petrosal connecting the middle meningeal ; (M), plexus with the facial nerve. (F A) facial artery, communication with sub-maxillary ganglion.—*From* "Hermann's Physiology."



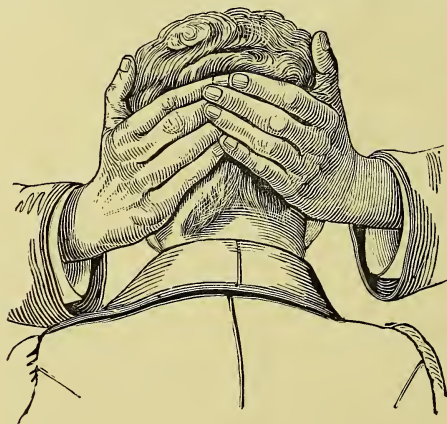


CHAPTER VII.

OTHER THERAPEUTICAL REMEDIES.

[*Massage, Depletion, Counter Irritation.*—This is a method of treatment which I have found of service in certain cases of nervous deafness, attended by tinnitus, and in “progressive deafness” due to chronic middle-ear

FIG. 58.



changes, and also in neuralgia of the tympanum. I do not pretend to explain how it acts. But it has in some cases decidedly a beneficial effect. I direct massage over the mastoid regions to be carried out thus :—The

patient is seated opposite the masseur or masseuse, who stands in front, with the hands laid on each side of the occiput. Pressure is then made by rotating the hand in an upward direction.

This movement may be alternated with *tapotement* (fig. 59). The lobe of the ear is drawn back with the fingers of one hand, while the strokes on the mastoid are rapidly made with the fore and middle fingers of the other (fig. 59). Also, massage can be practised by friction

FIG. 59.



with the fingers, the head being in the same position as in fig. 58. This massage should be carried out twice daily, for some ten to fifteen minutes at a sitting. I direct the massage to be wet; that is, the mastoid is smeared over with a solution of menthol (one part in seven), or the fingers of the operator are moistened with the same solution.

Depletion and Counter Irritation.—I have several times known a throbbing tinnitus relieved by the application

of one or two leeches, applied inside or under the concha. One patient of mine, a medical friend, was in the habit, whenever the tinnitus became distressingly loud, of applying a few leeches in this manner. This always gave him relief for some time from the "thumping noise" he complained of, and the sense of fulness. In the same manner I have known gentle counter-irritation with the charta epispastica, or a small portion of D'Albespeyres' dressing laid over the mastoid, mitigate the noise. A good counter-irritant embrocation for this purpose is the following:—

R. Tinct. Capsici.
 Tinct. Aconiti.
 Spt. Armoraciæ Co.
 Chloroform ā ā ʒii. M.

or

Sol. Menthol (1 in 7) ʒvi.
 Ol Sinapis ʒii.

This latter solution is to be applied gently to the mastoid a few times in the day. Such remedies are at best but palliative; still, anything that affords even temporary relief from the distressing noise will be welcomed by the sufferer.

Electrical Treatment of Tinnitus.—As regards galvanism and its effects in tinnitus, I may say at once that personally it is a remedy I cannot strongly recommend and am not much in favour of, for the following reasons:—

It is uncertain in its effects, frequently causing grave aggravation of the subjective noises (the fact that the galvanic current is more powerful in originating subjective sensations in the morbid than in the healthy auditory nerve (Benedikt) is not to be forgotten.

The dosage of it is difficult to measure. In the hands of those not accustomed to electrical manipulation it is a most haphazard treatment in that form of nerve dis-

turbance that requires technical skill in manipulation, and fineness of adjustment in appliance.*

“My accumulated experience,” says Politzer, “indicates that galvanic treatment effects a lasting improvement in the function of hearing only in a few cases, and complete removal of the subjective noises extremely rarely; but that very often, after longer or shorter treatment, the intensity of the subjective noises and their annoyance are lessened for a long time, and that besides, the head symptoms accompanying ear diseases are either quite removed or greatly improved. On the other hand, he notices that aggravation of the symptoms sometimes follows the galvanic treatment, the noises becoming more intense, and general excitement attending even a few sittings.”

If we now take Gruber's opinion and compare it with that of Politzer we find it is as follows:—“As regards the employment of electricity from his own experience, he entirely agrees with Schwartze, who disputes altogether the accuracy of Brenner's conclusions as expressed in his well-known formula in reference to Brenner's statements about ‘electro-diagnosis.’ Neither, unfortunately, can he say much as to the effects of electricity in aural diseases from a therapeutical point of view. The induced current appears most serviceable in cases in which there is a paretic condition of the internal muscles (Weber-Liel). Perhaps, too, the

* The application of a current of only a few cells in the region of the mastoid process is apt, without great care, to produce dangerous giddiness. This is, however, easily avoided by employing a “high tension” current of, say, 30 cells, reduced down by means of the water rheostat introduced into the circuit. This should be regulated so that the galvanometer shews $\frac{1}{2}$ to 1 milliampère, when the wetted electrodes are pressed together. With this high external resistance in the circuit it will be noticed that when the head is included in the circuit, practically no diminution in the current will be indicated by the galvanometer.

electrolytic action of the galvanic current may have an influence, as Schwartze has suggested, upon plastic processes in the middle ear; though the results hitherto obtained are not of a very favourable kind. With respect to particular symptoms, it is certainly true that galvanism is frequently capable of temporarily relieving or removing the subjective auditory sensations. It is nevertheless well ascertained that a permanent cure of these is an extremely rare occurrence, and that in the majority of instances the noises return after a few hours, sometimes in a much more intense degree."

"In such cases, or in those in which other morbid symptoms are increased by the application of electricity, its further employment should be undertaken with much circumspection, as thereby the condition may be considerably aggravated. Electricity may tend to improve the hearing power when general nervous affections are present which are benefited by this mode of treatment. The author has, however, not been able to convince himself of its efficacy in primary disease of the auditory nerve. If he were to draw a conclusion from his own experience of its action, he should in general agree with Bettelheim, who says that though it may be proper to employ it in cases of nervous aural affections after long continued treatment conducted on ordinary principles has proved fruitless, yet it would not be good practice to do so before everything else had been tried."

The satisfactory application of electricity* to the ear is in practice attended with many difficulties. Patients are so differently constituted to bear even weak currents, some refusing altogether to submit to internal galvanism; they are impatient of a treatment which is unpleasant if they do not experience speedy results in the

* Author's *Practitioners' Handbook*, 3rd edition, p. 157.

diminution of the noises or the deafness ; nor can the practitioner truthfully deny that there is much that is experimental in the treatment.

These expressions of opinion on the part of such experienced authorities I venture to quote, as I feel that it

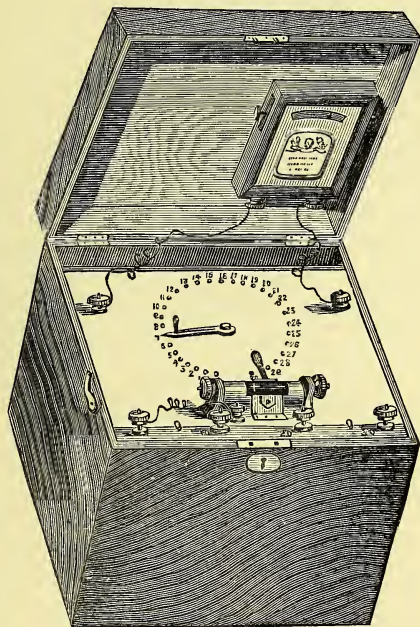


FIG 60.

Portable Voltaic Battery for general application, 40 Leclanche cells, Accessories, Collector, Interrupter, Current Reverser, and Galvanometer (Coxeter).

completely accords with my own experience of galvanism. In cases in which it has done good I have always been in doubt if the benefit was not as much derived from other treatment accompanying its use as from

the galvanism alone. We cannot rationally expect much benefit from any physiological or therapeutical effects of electricity in those cases in which an examination affords clear proof of serious organic changes in the middle ear or labyrinth. It is rather in those patients in which the examination by the speculum, otoscope, and tuning-fork points to tubal collapse as the principal cause of the tinnitus, and that other correlative evidence leads to a belief that there is a condition of enervation not alone of the tubal but also of the tympanic muscles, producing by pressure or otherwise disturbance of equilibration in the labyrinth, that electricity is likely to be of service.

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CHAPTER VIII.

AURAL ELECTRO-THERAPEUTICS.

HAVING thus expressed my present feeling as to the advantage of galvanism in the treatment of tinnitus, I consider the subject sufficiently *sub judice* and of that importance to place this brief review of the whole question before my readers. I am indebted for this summary to my friend, Dr. James Cagney, (St. Mary's Hospital), who has devoted special attention to the subject of electro-therapeutics.

Excitation of the auditory nerve has been carried out in various ways by different observers, but in the author's opinion the best method is that of Brenner, which was adopted also by Erb. The indifferent electrode—a plate of large size—is placed over the back of the neck, and the circuit is completed by pressing a sponge electrode of medium size over the external ear so as completely to occlude the external meatus. Both electrodes should be thoroughly soaked in water or a solution of common salt. Since the results depend upon the subjective sensations of the patient, he should be told what to expect and made to disregard concomitant sensations. In some healthy persons the auditory reaction cannot be obtained, because the auditory nerve, being situated deeply and in the neighbourhood of very sensitive organs, a current sufficiently strong for its stimulation is apt to cause intolerable discomfort.

In disease, on the other hand, a galvanic hyperæsthesia of the auditory nerve commonly exists, and on this fact depends in large measure the practical utility of the procedure to be described.

With the electrodes disposed in the manner indicated, a weak current is passed and repeated cathodic closures are made. If the current be slowly increased, a point will be reached at which cathodic closure is always attended by a definite sound, and with the same strength of current anodic opening causes a similar but feebler sound. In this way is obtained the normal auditory formula :—

KC. S'	Kathode closure.	Loud sound.
KO ...	Kathode opening.	<i>Nil.</i>
AC ...	Anode closure.	<i>Nil.</i>
AO ...	Anode opening.	Weak sound.
—Erb.		

Or with strong currents, the complete formula :—

KC. S'	...	...	...	Loud sound.
KD. S>	...	...	...	Sound diminishing and disappearing.
KO ...	...	...	...	<i>Nil.</i>
AC ...	...	...	...	<i>Nil.</i>
AD ...	Anode duration.			<i>Nil.</i>
AO. s.	...	...	...	Short weak sound.
—Erb.				

The Auditory Reaction in Disease.

The auditory nerve reacts to galvanic currents in a very characteristic manner in disease. The affections to which this statement applies are especially apt to be attended with obstinate tinnitus. They are, moreover, of all others the most likely to be benefited by electrical treatment, and since the form which the latter should assume will be directly suggested in any given case by the results of investigation, it is important to possess

some knowledge of the method in which this may be conducted.

There is another fact which renders this class of cases especially suited to the purpose. It has been mentioned that excitation of the auditory nerve in health is often difficult, sometimes impossible, because strong currents are needed to effect it, and these cause discomfort by their action on other parts, such as the visual apparatus, the trigeminus facial and gustatory nerves, and the brain itself. In disease on the other hand, galvanic hyperæsthesia of the auditory, in which the nerve responds to very feeble currents, is constantly present. This has been explained in a very satisfactory manner by Brenner. The special senses, when deprived for long of the appropriate stimulus, are apt to exhibit a condition of craving or excessive excitability for such as may yet reach them. A familiar instance is the dazzling effect of light after prolonged detention in the dark, and doubtless many cases of tinnitus in those who are wholly or partially deaf, may be accounted for in the same way. The electrical examination of the auditory nerve is conducted in the same manner as in health, but generally weaker currents will suffice.

Simple Galvanic Hyperæsthesia.—In this condition the auditory nerve is more readily excitable than in health, but there is no change in the normal formula. It is apt to occur with moderate disturbance of hearing, associated with thickening, retraction, or slight atrophy of the membrana tympani; it is common in long standing ear disease, with tinnitus as the usual accompaniment, perforated tympanum, suppuration, otitis media, caries, fractures, traumatic, and especially rheumatic, facial paralysis. The degree of hyperæsthesia should be estimated where this is possible by a comparison with the sound ear; but the number of cells (4-8 instead of

12-16 in health), or of milliampères of current employed should always be recorded.

Simple galvanic hyperæsthesia is constantly observed in connection with subjective noises in the ear, apart from organic disease, and such are particularly amenable to electrical treatment. It is usually found that the sound ceases at once, and entirely with the passage of AC and AD, while it is aggravated by other stimuli.

Galvanic Hyperæsthesia, with Anomaly of the Formula.—The sounds in this case, besides being more readily evoked, are altogether different from those of health. They are variously described as whistling, buzzing, singing, humming, ringing, hissing, &c. They are loud and persistent. Though the sounds differ in different cases, and with the different phases of excitation, they are the same in the same case for each of these phases (KC. RD. AO', &c.). Further, there are superadded morbid sensations—usually at first an AC. and AD. sensation; later, one with KO. The following illustration is from one of Erb's cases:—

A man of fifty-four, with partial deafness, old-standing tinnitus, thickening and retraction of tympanum.

10 cells ...	KCWh'	...	Loud shrill whistling.
	KDWh ∞	...	Prolonged whistling.
	KO : h	...	Short humming.
	AC : H'	...	Loud buzzing and humming.
	ADH>	...	Same, fading.
	AOWh>	...	Whistling as in KC.

Sometimes the normal sensations are entirely lost, and the morbid ones only remain. There is then said to be *Conversion of the Formula*. The conditions in which anomaly and conversion of the formula occur are old aural disease, extensive destruction of the middle-ear, and labyrinthine trouble.

Qualitative Anomalies of the Galvanic Reaction of the

Auditory without Hyperæsthesia.—The anomalies in question are those that have just been described. They are of every conceivable variety. They appear to depend upon nutritive errors, and they may be due also to the action of vertical replacing of the actual poles in cases where structural changes have determined new paths for the current. They are met with in severe and inveterate ear disease, in rheumatic facial paralysis, and in central disorders.

Torpor of the Auditory Nerve.—This is a condition of diminished excitability (Donne), in severe and incurable disease in which for the most part the precise connection with structural changes is not apparent.

Electrical Treatment of Tinnitus Aurium.—From what has been said in the preceding paragraphs, it will appear that the behaviour of the auditory nerve to galvanic currents is apt to vary greatly, and it is unnecessary to insist that the appropriate treatment must depend upon the result of a previous investigation in each case. It is impossible to lay down rules for all. It is obvious that where the purpose is to allay subjective noises this may best be done by repeated application of the stimuli which are found by experiment to exercise a soothing effect, and where unusual difficulties are encountered treatment should be left to those whose experience has provided them with special skill. In this place will be described the method of treatment which is most useful in the greatest number of curable cases—the typical condition being that in which subjective noises of nervous origin accompany a simple galvanic hyperæsthesia without a change of formula. In respect of prognosis there is no difficulty. Those cases will be benefited in which it is found that the noises disappear or diminish under treatment. Others will not be benefited, with the exception perhaps

of certain cases of rheumatic facial paralysis in which electrical treatment may affect the primary disease.

In the typical case which we have taken it is from the application of anodic closure and anodic duration that benefit is to be expected. To secure these, without the subsequent influence of anodic opening, the use of a rheostat is indispensable. The electrodes already described are used. The indifferent electrode may be held in the hand instead of being placed upon the neck, and that over the ear is connected throughout with the positive pole of the battery. The current is allowed to flow, being at first very weak, and gradually more cells are added. The patient is questioned as to his sensations, and no further increase of current is made when the subjective noise has ceased or become muffled to the utmost. At this point the current is allowed to flow for about thirty seconds. Resistances are then slowly interposed by means of the rheostat until there is no reflection on the galvanometer. Repeated anodic closures are then made, each followed by anodic duration as before, and the current always removed by means of the rheostat. The current strength should always be determined in this way, by its effect, and the sitting should not last more than three minutes. It may be repeated daily, or on alternate days, and may have to be continued for many weeks before a complete cure is reached.

Treatment of Paralysis of the Tympanic Muscles.—The tensor tympani is supplied by a branch from the otic ganglion, and paralysis of this muscle may be assumed to be a part of paralysis of the motor portion of the trigeminus. This last condition, however, is one of great rarity, and belongs almost exclusively to intracranial disease involving the basal ganglia. It is, of course, impossible to recognize paralysis of the tensor tympani as a distinct affection, but there are certain

indications, to be presently described, which will form a useful guide to electrical treatment of the muscle.

The stapedius is innervated by a branch of the facial nerve, which is given off in the aqueductus Fallopii. The muscle must therefore suffer in lesions of the nerve or in those of a central origin. It does so also in those due to injury or caries involving the nerve in the first part of its course through the petrous bone. In accordance with the more ordinary views it would be expected that the stapedius would escape in cases of rheumatic facial paralysis, which constitute by far the most frequent and at the same time the most tractable forms of the affection in question. However this may be, and whatever the underlying anatomical conditions, disturbances of hearing are very common in rheumatic facial paralysis, persisting often after the grosser evidences of disease have disappeared, and manifesting especially a tendency to cause troublesome tinnitus. Under these circumstances the electrical treatment of the facial nerve within the bone, and of the stapedius which must at the same time be stimulated, is rationally suggested, and it has been approved by experience. If in a case of facial paralysis from otitis media or from injury or caries involving the aqueductus Fallopii, it be decided to resort to electrical treatment, the best method is galvanisation as described for tinnitus with auditory hyperæsthesia, which in most cases co-exists. Or with the same electrodes and points of application the faradic current may be substituted for, or used alternately with the galvanic. It is on the whole less apt to give rise to unpleasant sensations. In cases on the other hand of a distinctly rheumatic character, where deafness or tinnitus accompany or persist after paralysis of the facial the best treatment is that usually employed for the primary lesion. Two electrodes of convenient size are connected

with the poles of a galvanic battery. They may be of sponge or of metal, or carbon covered with wash leather, and should be thoroughly soaked with water holding common salt in solution. These are pressed firmly into the auriculo mastoid fossæ, and a current of three to eight milliampères is passed for from one to three minutes. At the same sitting, or on alternate sittings labile galvanisation of the entire facial area is practised. A medium anode is applied behind the ear, and the nerve twigs and facial muscles are individually submitted to the kathode (small electrode), which is passed along their course; 5-6 m.a. current strength will suffice, and the application should not exceed five minutes. This treatment is of undoubted utility, and its efficacy probably depends upon the intimate connection between the nuclei of the fifth and seventh nerves. It is perhaps impossible to stimulate the nucleus of the facial directly, since currents of sufficient strength cannot be borne; but this may be done vigorously, and a current of moderate strength passed through the whole course of the nerve in the manner described above.

Electrical stimulation of the tensor tympani can be very readily and certainly effected. We have seen that paralysis of this muscle is probably of rare occurrence, and that it cannot be certainly diagnosed, but paresis of the tensor tympani is a constant factor in facial paralysis from disease of the facial and trigeminus at the base of the skull, bulbar paralysis and diphtheria; and in stenosis and occlusion of the Eustachian tube from local causes. In these latter states electrical treatment is of great importance. It is carried out in various ways. It may be stated here that it is seldom necessary or advisable to pass an electrode within the Eustachian tube, and when this has to be done the operation should be confided to a skilled manipulator. In the great

majority of cases it is sufficient to place a small conical or sponge electrode from the mouth over the orifice of the Eustachian tube, where it can be easily felt above and behind the soft palate, while the circuit is completed by means of a disc electrode of convenient size held or strapped against the auriculo-mastoid fossa. If the galvanic current be employed the internal electrode should be connected with the negative pole. A current of moderate strength is then passed (5—8 ma), and in chronic disease repeated reversals may be tried. Much annoyance may be caused in the process from excessive salivation. This may be checked by applying a small sponge or a pad of lint over the orifice of the parotid duct. The sensibility of the mucous membrane may be allayed by the previous use of the cocaine spray, but some persons are remarkably tolerant of interference in this situation.

In one case of old standing referred to syphilis, the writer repeatedly passed very strong currents (15—18 ma) with benefit, and though salivation was profuse the patient complained of no discomfort. So energetic a measure, however, is not to be recommended. The faradic current may be applied in the same manner as the galvanic, and may be usefully alternated with it. For its strength the sensations of the patient are the best guide.

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APPENDIX.

Dr. ALEXANDER OGSTON, in the Cavendish lecture, delivered before the West London Medico-Chirurgical Society (*Med. Press and Circular*, June, 18th, 1890), on "*Unrecognised Lesions in the Labyrinth*" draws attention to "touch deafness" as well as deafness to sounds in cases of effusion into the labyrinth, unattended by any catarrhal processes in the middle ear, in which there are varying degrees and kinds of tinnitus. This tinnitus, Dr. Ogston says, is aggravated at night on going to bed, and diminishes in the morning. Noise and movement aggravate the tinnitus, so does stooping or blowing the nose. Giddiness, loss of balancing power, and sense of tension in the ear are accompanying symptoms. Recurrence of the attack and gradual diminution of hearing frequently attend the course of the affection, and the loss of high notes is never regained. This latter symptom Dr. Ogston regards as a most characteristic one. The hearing is impaired, as if the ear were closed by wax or a plug of cotton wool. When the range of hearing is tested it is found that a watch, heard by the good ear at twenty-five feet, is now audible on the affected side at a distance of only two feet, or perhaps even six inches or less, a loss of from eleven twelfths to forty-nine fiftieths of the power of hearing. The voice, as is usual in deafness, is better heard, and is not so accurate a means of testing the diminished sensation.

"This deafness gives rise to a singular phenomenon in the region of the external auditory meatus. When, in a normal ear, the finger is brought into contact with the skin around the meatus, the individual both feels and hears the contact. If the deafness described is present the contact of the finger is *felt* as usual, but is not so distinctly *heard*, and hence for three-quarters of an inch in front of and below the meatus, and over nearly the whole pinna, when the finger is rubbed gently so as to stir the fine hairs and the skin, the patient feels as if the part touched were benumbed (see diagram No. I, where the benumbed

area is shown), in marked contrast to the sound ear, where the usual familiar sensation is perceived.

“The numbness described is not a symptom peculiar to disease of the labyrinth, as anything that interferes with the conduction of sound to the internal ear will equally produce it. It can be caused by plugging the external auditory meatus pretty firmly with cotton wool, and it may

FIG. 61.



Area of Touch Deafness in Effusion into the Labyrinth.

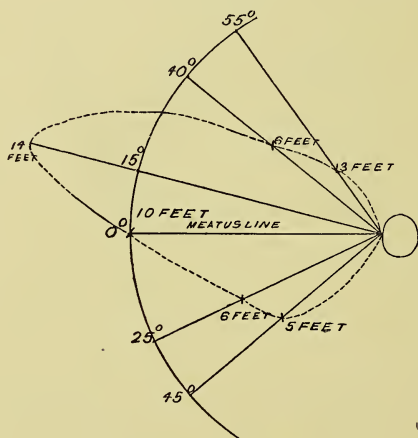
also exist where unusually large collections of cerumen block it up. It will not be well made out, however, in any condition unless the interference with hearing be considerable, and hence it is slightly marked or absent during the milder attacks of effusion into the labyrinth, and also in the severer attacks when the great degree of deafness accompanying their early stages is passing away.”

Testing the Acuteness of Hearing.

In the same lecture, Dr. OGSTON says :—“I do not think a better illustration could be given of the imperfection of our methods than

the fact that it is not generally known that the field of hearing of a normal ear has its limits in lateral directions, and that points of greater and less acuteness exist in it. If a person be seated with his ear horizontally directed towards a watch or other source of sound, and at such a distance from it that he can just distinctly perceive it, it will be found that as he inclines his head in various directions, the sound becomes more or less distinct, and at certain limits of inclination inaudible. As an instance of this I may give the measurements taken in the left ear of one of my patients, who suffered on his right side from the labyrinth disturbances I have de-

FIG. 62.

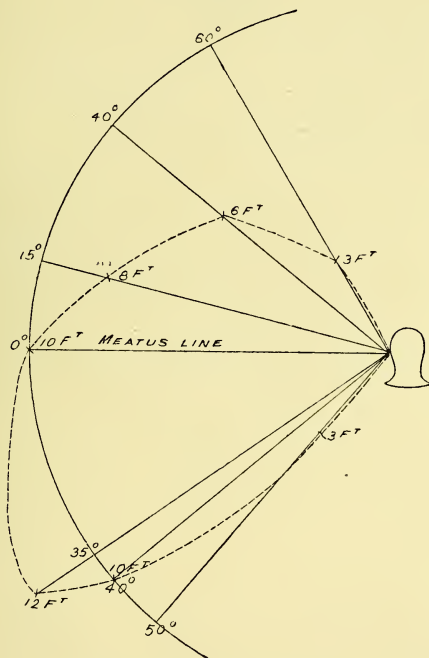


Hearing in the horizontal plane.

scribed, but in whom the left ear was normal. When the imaginary line joining his two external auditory meatus, which I may call the meatus line, was directed horizontally, and a watch was placed in the prolongation of this line at a distance of ten feet from his good ear, at which point he could just distinctly hear it, it was found that when he rotated his head for 15 degrees towards his back, that is, in a horizontal plane backwards, the watch was heard at a distance of 14 feet, or, which is the same thing, if his head remained stationary while the watch was moved forwards to a situation 15 degrees in front of the

meatus line, it was there heard at a distance of 14 feet. It was of course immaterial to the result whether the patient or the watch was moved. In testing further it was found that if the watch were moved forwards to an angle of forty degrees in front of the meatus line it was there heard only at 6 feet, and at 55 degrees only at 3 feet. The back

FIG. 63.



Hearing in the vertical plane.

part of the field showed a slow decrease of the range of hearing, the watch at 25 degrees backward being heard only at 6 feet, and at 40 degrees backward at 5 feet, beyond which the range fell to 3 feet and less. So that the patient's field of hearing embraced only 95 degrees of a circle, its point of greatest acuteness being 15 degrees in front of the meatus line."

"The diagram (fig. 62) will render this more intelligible. It corresponds to several other measurements I have taken of normal ears, and is, I think, a tolerably accurate representation of what is usually found in health; although the conditions under which I had to work when examining all these cases, particularly as regards noise and currents of air, were unfavourable to perfect accuracy.

"When the hearing in the vertical plane was next examined, it was found that here also the sound was not best heard when opposite the meatus. It was there audible at 10 feet, while at 15 degrees above the range diminished to 8 feet, 40 degrees above to 6 feet, and 60 degrees above to 3 feet and less; but below it slowly increased for 35 degrees, at which point it reached 12 feet, diminishing then to 10 feet at 40 degrees, and to 3 feet and less at 50 degrees as shown in the diagram (fig. 62). The point of most distinct hearing is therefore below the ear."

MEDICATED NASAL CYLINDERS.—These are small hollow glyco-gelatine cylinders, which are inserted into the nasal passage on hollow oral vulcanite plugs. These cylinders are variously medicated with different quantities of such drugs as bismuth, cocaine, hydrochlor., iodoform, acetate of lead, menthol, &c. The medicated cylinder is inserted on the vulcanite plug and introduced into the nasal passage. The process of liquefaction takes several hours, during the whole of which time the surface is exposed to the action of the drug and is moistened by the glyco-gelatine. Respiration can be carried on the whole time. Neither cylinder nor plug can slip back into the pharynx, as each plug is supplied anteriorly with a small thread by means of which the two are tied together. There is no caking or clogging, as with ointment and powders. They should only be used in the horizontal position.

MEDICATED CIGARETTES OF AUTHOR.

No. 1. Eucalyptus—Iodoform—Vanillin. 1 grain iodoform in each.

No. 2. Eucalyptus — Iodo-Salicylic Acid. 1 grain Iodo-Salicylic Acid in each.

No. 3. Coltsfoot—Iodoform—Vanillin—Eucalyptus. 1 grain Iodoform in each.

No. 4. Eucalyptus—Tobacco—Iodoform—Coffee. 1 grain Iodoform in each.

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